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This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts of more than 1300 documents.

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# AIR POLLUTION ABSTRACTS

ENVIRONMENTAL PROTECTION AGENCY
Air Pollution Control Office

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# AIR POLLUTION ABSTRACTS

Vol. 2, No. 2 February 1971

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Author Index .......... PA-1

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# INTRODUCTION

This periodical is published to inform APCO personnel and others of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, the bibliographic citation, an abstract, and the APTIC accession number are given.

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# SUBJECT FIELDS AND SCOPE NOTES

## 1. EMISSION SOURCES

Information pertaining to an industry, process, or material associated with air pollution. Documents in this category are concerned primarily with characteristics of a specific class of emission sources including types, rates, industries; secondary coverage may include effects, control methods, etc.

## 2. CONTROL METHODS

Includes equipment and both specific source control and general abatement efforts. Included are documents describing the operating principles, design, operation, efficiency, etc., of equipment and methods of removing pollutants. The scope of the document can vary from a device for a specific source to an approach applicable to an entire industry —e.g., automobiles.

## 3. MEASUREMENT METHODS

Includes equipment as well as methods. Confined to development, testing and evaluation of pollutant determination methods (sampling, analytical, monitoring) and equipment, as such. Data obtained by use of methods in specific applications are placed in the applicable subject categories.

## 4. AIR QUALITY MEASUREMENTS

Pollution measurements in the ambient air, generally related to specific geographical locations, such as area surveys. Also includes general reviews of area situations and emission source inventories.

## 5. ATMOSPHERIC INTERACTION

All chemical and physical phenomena occurring in the atmosphere. Included is material on dispersion, air pollution forecasts, meteorological effects, topographical effects, photochemical reactions in the atmosphere, etc. Laboratory studies of photochemical reactions are assigned to Basic Science and Technology.

## 6. BASIC SCIENCE AND TECHNOLOGY

General discussions or data compilations for the basic physical and chemical properties of pollutants. Theoretical and laboratory studies on related chemical and biological reactions and mechanisms. Mass transfer and other basic knowledge related to process engineering applications in emission control or abatement. Excludes photochemical studies in the atmosphere and biochemical studies related to effects of air pollution.

### 7. EFFECTS—HUMAN HEALTH

Covers medical and epidemiological studies; biological effects other than those on plants and livestock produced by air pollutants; laboratory animal experiments.

### 8. EFFECTS—PLANTS AND LIVESTOCK

Effects on vegetation—crops, trees, other plants—and on livestock as distinguished from laboratory experimental animals.

### 9. EFFECTS—MATERIALS

Deterioration, corrosion, etc., of physical materials, buildings, and structures.

### 10. ECONOMIC ASPECTS

Economic implications of air pollution and its control, e.g., economic losses from pollution damage, and costs of control programs or equipment in general.

### 11. STANDARDS AND CRITERIA

Recommended or adopted guides, criteria and standards for allowable emission limits or pollutant concentrations, air quality, equipment characteristics, and fuels.

### 12. LEGAL AND ADMINISTRATIVE

Legal aspects include legislation, ordinances, rules, litigation, hearings, decisions, etc. Administration covers administrative and miscellaneous information concerning control agencies and control and research programs. Typical topics are personnel, budgets, contractual activities and program descriptions.

### 13. SOCIAL ASPECTS

Sociological and psychological aspects such as social attitudes, public opinion studies, public relations, and public information.

### 14. GENERAL AND MISCELLANEOUS

Reviews of general problems, trends and background. Documents not assignable to other categories.

# AIR POLLUTION ABSTRACTS

## 1. EMISSION SOURCES

### INVESTIGATIONS INTO THE EFFECTS OF FLUORINE IMMISSIONS ON CATTLE IN THE NEIGHBORHOOD OF A HYDROFLUORIC ACID PLANT.

For primary bibliographic entry see Field 08.
APTIC-18268

### WORLD FUEL RESOURCES.

For primary bibliographic entry see Field 06.
APTIC-18276

### INVESTIGATION ON THE CONTRIBUTION OF ENGINE EXHAUSTS TO URBAN ATMOSPHERIC POLLUTION AT A STREET OF HEAVY TRAFFIC DENSITY IN YOKOHAMA.

(Yokohama Shinai no Dai Kotsuryo Chiten Gai Rojo ni okeru Jidosha Haigasu yorio no Taiki Osen Busshitsu.) Text in Japanese. Bunseki Kagaku (Japan Analyst) (Tokyo), 12:1057-1062, 1963. 10 refs.
Yoshitaka Kobayashi, Abe Tatsuyuki, Takeno Hiroshi, Saburo Kanno, and Fukui Shozo.
Identifiers: *Yokohama, *Automotive emissions, Asia, Japan, Pollutants, Air quality measurements, Analytical methods, Colorimetry, Carbon dioxide, Carbon monoxide, Nitrogen oxides, Nitric oxide (no), Nitrogen dioxide (no2), Sulfur oxides, Sulfur dioxide.

Effects of automobile exhausts on urban atmospheric pollution were studied during the period 1962 to 1963. The contaminants in the atmosphere were measured four times during this period at Takashima-cho junction, one of the most heavily traveled intersections in Yokohama. The concentrations of CO, CO2, SO2, NO, NO2, and Pb were measured by using the detector tube and colorimetric methods. Traffic density was simultaneously obtained by using a manual counter for ten minutes in each hour. The results indicated that the concentration of CO ranged from 1 to 40 ppm; CO2 from 340 to 400 ppm; SO2 from 0.2 to 11.3 ppm; NO from 6 to 153 ppm; NO2 from 1 to 64 ppm; and Pb from 1.4 to 41.4 micro g/3 cu m. The concentrations of these contaminants showed two maximum peaks at 9 am and 5 pm and also one minimum level at 4 am. The correlation between the concentration of air contaminants (CO, NO, NO2, and Pb) and the traffic density was found to be quite high.
APTIC-18280

### AIR POLLUTION FROM CUPOLAS.

(Luftfororeningar fran kupolugnar och tekniska mojligheter att begransa dessa.) Text in Swedish. Statens Naturvardsverk (Stockholm), 90p., 1968. 74 refs.
Lars Lindau, and L. Schweitz.
Identifiers: *Cupolas, *Dust, *Control equipment, *Sulfur oxides, Dusts, Coke, Electrostatic precipitators, Bag filters, Scrubbers, Venturi scrubbers, Wet cyclones, Gases, Costs.

The investigation deals with air pollution problems with cupolas and the purpose of the survey is to supply information to the Swedish authorities dealing with air pollution control. The investigations have concentrated on the costs of air pollution equipment. The amount of dust in the raw gas is 0.5-30 kg per ton iron and the dust content is 1-100 g per cu m at standard temperature and pressure. The coke used in the cupola contains about 1% sulfur. 50-70% of this goes to the iron and the slag, while the rest is transferred to the air phase, where it is oxidized to SO2. This means an emission of 1 kg SO2 per ton iron, which corresponds to a maximum content of 0.1% in the flue gas. The amount of CO is normally small, about 50-100 kg per ton iron without afterburning and 0-25 kg per ton iron with afterburning. In some cupolas 1-2% fluorspar is used in the charge, which can give water soluable fluorine compounds in the dust. The amounts are very small. The costs for 7 different arresters have been calculated for 4 different cupola sizes, 3, 6, 12 and 24 tons per hr. The different types of arresters dealt with the cyclones, wet caps, venturi scrubbers, wet and dry electrostatic precipitators, and bag-houses. The investment cost varies between $6000. and $160,000., and the total cost varies between $1000. and $63,000. per year and the cost per kg melted iron varies between 0.02 and 2.40 cents. This means very big variations for different arresters, cupola sizes and methods for the outlet of the gas. The costs for the arrester compared with the other expenses in a cupola installation can vary between 8 and 100%. Calculated on the fixed expenses the costs for air pollution control are 6-18%. A recommended emission standard is given.
APTIC-18293

### EXHAUST GASES FROM GASOLINE POWERED VEHICLES.

(Avgaser fran bensindrivna bilar.) Text in Swedish. Kommunikationsdepartmentet ledningsgrupp rorande utvecklingsarbete pa bilavgasomradet, 112p., 1968. 51 refs.
G. Gerhardson.
Identifiers: *Automotive emissions, *Automotive emission control, *Sweden, Streets, Odors, Smog, Gasolines, Field tests, Hydrocarbons, Lead compounds, Carbon monoxide, Nitrogen oxides, Costs, Emission standards.

The investigation deals with the occurrence and effects of automotive exhaust smoke, statistical information, trends of development, emission of air pollutants from gasoline fueled automobiles, and available methods to reduce the emissions. The purpose of the survey is to supply information to the Swedish government about air pollution problems from gasoline powered vehicles. The investigation is ended with proposals for reducing the lead content of gasolines. The substances dealt with are carbon monoxide, hydrocarbons, odorous and irritating substances, oxides of nitrogen, and particulates among which lead compounds are discussed. Measurements and calculations show that the pollution level on heavily trafficked streets normally does not reach levels which cause acute health effects by the separate substances. Uncertainty exists concerning synergistic and long-term-exposure effects. Bad odor and soiling are evident inconveniences from auto exhaust gases. Photochemical smog, however, has not occurred in Sweden. The suggested standards by the Guidance Group are 45 grams of carbon monoxide and 2.2 grams of hydrocarbons per dilometer. Corresponding average values are 30 grams carbon monoxide and 1.5 grams of hydrocarbons per kilometer, which means that the emissions will be reduced by about 40 per cent of the present level. For the model year 1973 the group considers that technical development has made it possible to tighten the standards. Sixty per cent reduction of the carbon monoxide and 50 per cent of the hydrocarbons should then be possible. After two more years, in 1975, it should be possible to obtain 70 per cent reduction of the carbon monoxide and 60 per cent of the hydrocarbons.
APTIC-18294

### AIR POLLUTION AND DISTRICT HEATING.

(Luftfororening och lokaluppvarmning.) Text in Swedish. Statens naturvardsverk (Stockholm), Publikationer No. 2, 32p., 1969. 1 ref.
G. Persson, and B. Westergard.
Identifiers: *Soot, *Sulfur dioxide, *Emission standards, *Sweden, Domestic heating, Air quality measurements.

Soot and sulphur dioxide are investigated in Swedish towns with over 15,000 inhabitants. Measurements show that the Swedish standard for SO2 concentration (5 pphm) during 1 month is overstepped in most of the larger towns. The lower limit seems to be towns with at least 40,000 inhabitants. The investigation shows, however, that towns with centralized heating have considerably lower SO2 concentration and even soot to a certain extent. Centralized heating is also important for the local concentration of SO2 within a town. Tables are presented of the results of soot and SO2 measurements. Furthermore, the paper describes the situation of district heating today and a prognosis of the situation in Sweden in 1979. Many of the largest towns will have more than 70 per cent connection to a central heating plant in ten years.
APTIC-18295

### DIMENSIONING OF FLUES AND RUNNING CONDITIONS IN MEDIUM-SIZED HEATING PLANTS.

(Rokkanalers dimensionering och driftforhallanden i medelstora panncentraler.) Text in Swedish. National Swedish Building Research (Statens Byggforskningsinstitut, Stockholm, Sweden), 1969. 5 refs.
Olov Larsson.
Identifiers: *Stacks, *Control methods, *Equipment standards, Corrosion, Sweden, Soot, Smokes, Boilers, Fuel oils, Electric power production, Domestic heating, Particle counters, Gas sampling, Source sampling, Firing methods, So2 removal (combustion products), Ventilation, Carbon dioxide, Sulfur dioxide, Temperature.

The National Swedish Institute for Building Research has conducted a field study of both old and new heating plants in the southern and central parts of Sweden with maximum effects varying from 200 to 8200 Mcal/h. All plants were fired with oil fuel, classes 3 or 4 (some with class 4 which contains little sulphur). The overwhelming majority of the plants were equipped with welded boilers, while 75% of the oil burners are of the pressure jet or emulsion burner types, 18% low air pressure, and the rest had rotary burners. Approximately 50% of the heating plants studied have natural ventilation units and about 30% of those heating plants studied have natural ventilation units and about 30% of those plants with mechanical ventilation (flue gas fan) have separate flues leading from each boiler to the mouth of the chimney. The concentration of solid matter in the flues was measured for different boiler loads and the amount of matter per kg of fuel oil was calculated. Temperatures of flue gases, amounts of soot, velocity of flue gases, static pressure, excess air, and temperature of internal walls were also measured. The mean for the concentration of solid matter at all tests averaged about 74 mg/cu m. Flue gases, while the corresponding mean for the amount of solid matter present was 1.7 g/kg fuel oil. The usual estimate for the CO2 content in the flue gases is 12-14%, at which level 74 mg/cu m would correspond to 1.0 g/kg of fuel oil. The survey showed, however, that such high CO2 contents rarely occur at the point where the content of solid matter is measured. The mean for the CO2 content in the plants studied was 7.5%. Only a small number of the plants tested had chimneys whose heights with regard to the amount of flue gases emitted and to the sulphur content in the oil were in accordance with the advice and instructions published by the authorities. Measurements of soot quantities according to Bacharach show that only about 35% of the boilers have Bacharach number 3 or less. Measurements showed that about 80% of the plants had, under normal running conditions, flue gas temperatures lower than 145 C at the mouth of the chimney. About 30% of the plants had flue gas temperatures lower than 100 C. The report also describes the velocity of flue gases, total amount of air leakage and damages caused by corrosion.
APTIC-18296

### HEAVY METALS WITHIN THE REGION OF NORRKOPING.

For primary bibliographic entry see Field 03.
APTIC-18297

### AIR POLLUTION AND THE MANUFACTURE OF INORGANIC CHEMICALS.

For primary bibliographic entry see Field 02.
APTIC-18305

### RECENT TRENDS IN COPPER METALLURGY.

Mineral Industries, 2 (4): 18p., July 1968. 86 refs.
W. B. Pings, and Earl L. Rau.
Identifiers: *Primary metallurgical process, *Copper compounds, *Mineral processing, Bacteria, Mining, Primary metallurgical processing, Precipitation, Cyanides, Oxides, Sulfides, Electrolysis, Ions, Pressure.

Two major sources of copper are sulfide ores and oxide ores. The predominant CuS minerals are chalcopyrite, chalcocite, bornite, enargite, and covellite. The chief oxidized minerals are chrysocolla, malachite, and azurite. Sulfide ores are treated by concentrating, smelting, and refining. Oxidized ores are treated by leaching followed by precipitation or electrowinning. Recent trends in leaching have been aimed at higher Cu recovery from given ores, or the production of Cu from ores that could not be processed economically in the past. Bacterial, pressure, and cyanide leaching are covered. Cone type and V-trough precipitators use iron to precipitate Cu from CuSO4 solutions. Sponge iron is being incorporated in these processes to give faster precipitation. Precipitation from aqueous solutions by reduction with H,S and SO2, and HCN and SO2 are discussed. Advances in solvent extraction have increased Cu recovery to better than 98%. Estimated installed plant cost for a liquid ion exchange solvent extraction plant is between $500 and $600/gal/min. A new electrolytic cell (CCS process) is more efficient than standard cells, produces smooth cathode deposition, and operates at lower costs. In situ leaching following nuclear blasting shows promise as a new mining technology. The WORCRA and Normanda processes are relatively new pyrometallurgical techniques which increase smelting efficiency. Continuous converting and smelting in converters with oxygen have reduced the number of steps in copper production with attending decreases in capital and operating costs. Scrap metal can now be successfully stripped of copper by dipping in molten barium chloride at 1250 C. Iron and steel are not affected by the bath, and the usual trapped puddle problem is eliminated.
APTIC-18306

### LNG PIPELINES.

For primary bibliographic entry see Field 02.
APTIC-22215

### CANVEY ISLAND: UNDERGROUND LIQUID GAS STORAGE.

For primary bibliographic entry see Field 02.
APTIC-22230

### CARCINOGENIC PROBLEMS FROM POLLUTED AIR. ANALYSIS OF AUTOMOBILE EXHAUST COMBUSTION GAS.

(Il problema della cancerogenicita dell'aria inquinata. I. Analisi dei gas di scarico dei motori a scoppio). Text in Italian. Riv. Ital. Igiene (Pisa), vol. 26:438-453, 1966. 25 refs.
A. Candeli, G. Barboni, and Berioli Galoforo.
Identifiers: *Engine exhausts, *Combustion gases, *Polynuclear compounds, Carcinogens, Italy, Gasolines, Automobiles, Chemical composition, Gas sampling, Anthracenes, Fluoranthenes, Benzo (3-4)pyrene.

The indentification of seven polycyclic aromatic hydrocarbons in the gasoline engine exhaust of a 500 Fiat, working in neutral for two hours, is described. The compounds are anthracene, fluoranthene, pyrene, 1:2-benzanthracene, 1:2-benzpyrene, 3:4-benzpyrene, coronene, and compound not yet identified and called 'compound 409'. Pyrene, 1:2-benzanthracene, 3:4-benzpyrene, and coronene are present in the following concentrations: 703, 381, 52, 612 micrograms for the exhaust gas from one liter of gasoline. The analysis is carried out on 3771 grams of particulate matter obtained from 112 mc of exhaust gas filtered through a Staplex apparatus. The residue is extracted with acetone; 2481 grams of acetone extract are chromatographed on Alumina column and the eluates are examined with the spectrophotometric technique. (Author abstract modified)
APTIC-22238

### THE THREAT POSED BY DUST AND INDUSTRIAL GASES EMITTED BY CENTRAL HEATING PLANTS AND OTHER AIR POLLUTION SOURCES.

For primary bibliographic entry see Field 07.
APTIC-22246

### OVER-THE-ROAD TRANSPORTATION OF LIQUID METHANE.

For primary bibliographic entry see Field 02.
APTIC-22261

### TANK-WITHIN-A-TANK STORES LNG.

For primary bibliographic entry see Field 02.
APTIC-22271

### CAVERN STORAGE OF LIQUEFIED NATURAL GAS.

For primary bibliographic entry see Field 02.
APTIC-22282

### PROGRESS IN L.N.G. STORAGE AND TRANSPORT.

For primary bibliographic entry see Field 02.
APTIC-22288

### CLEVELAND -- THE CENTER OF THE NATURAL GAS INDUSTRY.

For primary bibliographic entry see Field 02.
APTIC-22289

### SPECIAL STUDIES FOR INCINERATORS FOR THE GOVERNMENT OF THE DISTRICT OF COLUMBIA.

PHS Grant D01-SW-00038-01, Rept. SW-1d, PHS Publ. 1748, 80p., 1968. 84 refs.
Personal Author Not Recorded.
Identifiers: *Incineration, *Design criteria, Costs, Stack gases, Particulates, Collectors, Electrostatic precipitators, By-product recovery, Compression.

Six special studies, prepared as a part of the evaluations leading to a design for an incinerator for the District of Columbia, is presented. Topics of the studies include: incinerator effluent gases, control laboratory, size reduction of oversize burnable waste, size reduction of bulky metal objects by compression presses, heat recovery, and can-metal recovery. The incinerator effluent stream contains inorganic and organic substances in the form of gases and particulates. Some of these constituents are toxic and corrosive. Electrostatic precipitators preceded by mechanical collectors are recommended for air pollution control. Itemized lists of instrumentation and laboratory equipment and their estimated installed costs are presented. The installation of a shredder for size reduction is recommended. The use of compression presses to reduce the size of bulky metal objects is acceptable under certain conditions; the alternate use of outside contractors for metal shredding as a potentially more economical solution is recommended. The economics of the proposed plant do not justify the installation of heat recovery equipment. Because of the low price obtainable for recovered can metal, it is concluded that facilities of this type should not be included in the proposed incinerator project. (Author abstract modified)
APTIC-22296

### COMPARISON OF CALCULATED AND MEASURED MAXIMUM GROUND-LEVEL SO2 CONCENTRATIONS AND THEIR DISTANCE DOWNWIND FROM STRONG EMISSION SOURCES (POWER PLANTS).

Staub (English translation from German of: Staub, Reinhaltung Luft), 29 (12):14-20, Dec. 1969. 7 refs.
CFSTI: TT 69-55002/12
Heinz Fortak.
Identifiers: *Electric power production, *Ground level, *Sulfur dioxide, Germany, Stack gases, Diffusion models, Plume behavior, Point sources, Winds.

A simplified version of the theory of atmospheric diffusion is applied to simulate maximum ground-level sulfur dioxide concentrations measured near large power plants. The results depend strongly on the special form of the plume rise formula. Neither Csanady's original formula nor the new optimized version of it give satisfactory results. A slight modification of the exponent in the optimized Csanady-formula however seems to simulate the measurements in the best way. (Author abstract)
APTIC-22313

### LIQUEFIED NATURAL GAS STORAGE IN ABOVE GROUND TANKS.

For primary bibliographic entry see Field 02.
APTIC-22321

### LEAD ACCUMULATION IN SOILS NEAR HIGHWAYS IN THE TWIN CITIES METROPOLITAN AREA.

Soil Sci. Soc. Am. Proc., 33 (1):152-153, 1969. 11 refs.
M. J. Singer, and L. Hanson.
Identifiers: *Highways, *Soils, *Tetraethyl lead, Urban areas, Engine exhausts, Bromides.

The use of tetraethyl lead in vehicle fuel has resulted in a general increase in the lead content of both the atmosphere and the soil. Most of the lead from gasoline exhausts is deposited as the highly soluble chlorobromide. The soil adjacent to 12 highways in the Minneapolis-St. Paul metropolitan area had lead accumulations in the range of 128 to 700 ppm. The lead concentrations found were related to traffic volume and distance from the highway. Further studies are needed to determine if biological or environmental hazards are possible from the lead contained in these soils. (Author abstract modified)
APTIC-22367

### ECOLOGY OF HEAVY METALS- A REGIONAL AND HISTORICAL STUDY.

Botan. Notiser, vol. 122:248-259, 1969. 10 refs.
Ake Ruhling, and Germund Tyler.
Identifiers: *Plants (botany), *Sweden, *Metal compounds, Plant indicators, Chromium compounds, Copper compounds, Lead compounds, Nickel compounds, Zinc compounds.

Samples of the moss Hypnum cupressiforme collected during 1968-69 in northeastern Gotaland, the low-land areas and the ridge areas of Skane (southern Sweden) were analysed for lead, zinc, copper, nickel and chromium. The concentration of these metals were significantly lower in the north-eastern area than in the areas of Skane, particularly in Pb, Ni, and Cr. Between the two areas in Skane differences were only established for Pb and Cu, with the largest concentrations in the humid ridge areas. The differences in the concentrations of these heavy metals between north-eastern Gotaland and Skane will be explained by the geographical position with respect to the large industrial regions of Europe. Samples of the same species, collected in Skane during 1870-1943 have also been analysed. Significant increases during the decades around 1900 were demonstrated for Cu and Zn. In the concentrations of Ni a rapid rise has occurred since about 1920, when this metal was introduced in the world production. The content of Ni in the samples from 1969 is more than twice as large as in the samples collected before 1920. The historical trends in the concentrations of Pb have earlier been demonstrated. There is little

doubt that the rise in the concentrations of these metals is an effect of a larger air-borne supply, originating from human activity. (Author abstract modified)
APTIC-22370

### SMOKE POLLUTION IN DWELLINGS OF INFANTS WITH BRONCHOPNEUMONIA.

For primary bibliographic entry see Field 07.
APTIC-22379

### SULFUR RETENTION IN ANTHRACITE ASH.

Bureau of Mines, Washington, D. C., Rept. of Investigation 7160, 12p., July 1968. 5 refs.
J. J. Demeter, and D. Bienstock.
Identifiers: *Retention, *Ashes, *Coal characteristics, *Sulfur compounds.

Anthracite from the four producing regions in Pennsylvania was both ashed in the laboratory and burned on a chain-grate stoker to determine the sulfur-retention properties of its ash. The retention of sulfur in laboratory-prepared anthracite ash is related to ashing temperature and to the amounts of sulfur and calcium present in the coal. At the usual laboratory ashing temperature of 750 C, sulfur retention ranges from 0.8 to 13.2% of the total coal sulfur. Sulfur retention in the ash is negligible, 0 to 0.3%, at 1200 C, which is the thermal decomposition temperature of calcium sulfate; thus calcium sulfate does not form and cannot serve as a sulfur-retaining agent. In several tests the anthracite was mixed with 6 or 10% dolomite prior to firing in the chain-grate stoker. The dolomite did not improve sulfur retention due to the high temperature in the fuel bed. Sulfur retention is, however, related to the unburned carbon in the ash. The relationship of the percentage of original coal sulfur retained in the ash (Y) to the percentage of the original carbon in the coal remaining in the ash (X) is expressed by Y equals minus 0.579 plus 0.914X. The percentage of sulfur retained is almost directly proportionate to the percentage of original coal carbon in the ash. (Author abstract modified)
APTIC-22387

### DISCHARGE LIMITATION FOR REFUSE INCINERATORS. (FWDP 12). APPENDIX C.

Preprint, 16p., 1965. 38 refs. Translated from German. Belov and Associates, Denver, Colo., 25p., Feb. 1970.
Personal Author Not Recorded.
Identifiers: *Equipment standards, *Incineration, *Design criteria, Germany, Combustion products, Dusts, Stacks, Collectors, Centrifugal separators, Electrostatic precipitators.

A provisional standard is provided for refuse incineration which includes descriptions of various types of incineration plants. Median values and typical characteristics for incineration are given for different kinds of refuse. Heating values, chemical contents of refuse, loads on grate areas, temperatures, and related parameters are included in the tabular presentation. The reduction of dusts from the combustion gas is treated with regards to what types of operations, mechanisms, actions, or abuses would contribute to the decrease or the increase in the formation of dust particles. The subject is examined according to fuel and fuel utilization, grate construction, burner space, air draft from below for pre-drying, secondary aeration, successive heating areas, funnel for flying dust, and cleaning installations. Various suggestions are offered in choosing between cyclones, electrical dust removers and other dust collectors. The construction and the efficiency of the burner installation, fuel and refuse characteristics, amount and granulation and characteristics of coarse dust, and available space for the dust remover must be known in order to make the choice. Typical values of removal efficiency are given for different removal systems and are tabulated according to the required draft pressure and location of use in the incineration facility. In addition, diverse factors that contribute to favorable and unfavorable degrees of dust separation in removers are listed, and some suggestions for the reduction of emissions are given.
APTIC-22389

### THE RELATION BETWEEN KNOCK AND EXHAUST EMISSIONS OF A SPARK IGNITION ENGINE.

Preprint, Society of Automotive Engineers, New York, 5p., 1970. 14 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 12-16, 1970, Paper 700062.)
L. C. Duke, S. S. Lestz, and W. E. Meyer.
Identifiers: *Knock, *Engine exhausts, *Spark ignition engines, Air-fuel ratio, Spark timing, Hydrocarbons, Carbon dioxide, Carbon monoxide, Nitric oxide (no), Combustion, Pressure.

The effect of knock intensity on exhaust emissions is examined in a single cylinder spark ignition engine. The exhaust components surveyed are carbon monoxide, carbon dioxide, oxides of nitrogen (as nitric oxide), and total unburned hydrocarbons. Knock is induced solely by changing the spark timing. To describe knock intensity quantitatively, the magnitudes of the rate of pressure irregularities occurring during the combustion process are utilized. The use of the rate of pressure change to define a quantitative knock intensity scale is supported by an apparent generalization of the stoichiometric air-fuel ratio data. Graphs are presented that indicate the dependency of power output as well as exhaust emissions on knock intensity for various air-fuel ratios. (Author abstract modified)
APTIC-22445

### RELATIONSHIP BETWEEN AUTO EXHAUST COMPOSITION AND SMOG.

For primary bibliographic entry see Field 07.
APTIC-22459

### FROZEN-STORAGE PROJECT FOR LIQUID METHANE GOES AHEAD.

For primary bibliographic entry see Field 02.
APTIC-22464

### POWER PART PARAMETERS AFFECTING LUBE OIL CONSUMPTION AND BLOWBY IN SMALL BORE, HIGH SPEED DIESELS.

Preprint, Society of Automotive Engineers, Inc., New York, 13p., 1969. 5 refs. Presented at the Society of Automotive Engineers., National Powerplant Meeting, Cleveland, Ohio, Oct. 27-29, 1969, Paper 690752.)
Paul R. Shepler, and Carl S. Weinberger.
Identifiers: *Blowby, *Diesel engines, *Engine design modification, Distillate oils, Design criteria.

Ten series of fractional factorial tests for oil consumption on nine small bore, high speed diesel engines reveal favorable factors for top, intermediate, and oil rings, pistons, and liners that may be used in the initial design of a diesel engine. Blowby is much less affected by these factors, and so the factors may be chosen for oil control with but little penalty to blowby control. An enormous amount of additional work is necessary to refine further the parameters tested and to investigate new parameters. (Author abstract)
APTIC-22479

### AIR POLLUTION CAUSED BY COKING PLANTS AND GASWORKS.

(Luftverunreiningung durch Kokereien und Gaswerke). Text in German. Energietechnik, 17 (12):556-559, Dec. 1967. 11 refs.
Hermann Telling.
Identifiers: *Coking plants, Costs, Emission standards, Monthly, Germany, Stack gases, Dusts, Coke, Chemical processing, Gas chromatography, Colorimetry, Electroconductivity analyzers, Konimeters, Tyndallometer, Control methods, Ammonia, Carbon monoxide, Sulfur dioxide, Hydrogen sulfide.

Solid and gaseous pollutants emitted by coking plants and gasworks, existing possibilities of reducing their emission, analytical methods available for their identification, and regulations governing air pollution are discussed. Ninety percent of the emission from anthracite coking plants originates in the furnace and slaking plants which generate coal and coke dust, aromatic hydrocarbons, and combustible and toxic gases like carbon monoxide, hydrogen sulfide, sulfur dioxide, and ammonia. Emissions from these plants vary widely, depending on technological factors, throughput, competence of operators, and quality of coke produced. Dust generation can be reduced by proper handling of coal, like sprinkling with water during unloading. The emission of pollutants during filling of the chambers can be reduced by a reduction of the filling time through the use of proper equipment and further reduced by combustion or purification. At best, the gaseous pollutants can thus be reduced by 60%. The best equipment for pollution control in coking plants was developed by the Koppers Co. Instruments available for the determination of dust pollution levels include the konimeter, Gast's dust balance, and the tyndalloscope; gaseous pollutants are determined by methods based on absorption of radiation, changes of conductivity, principles of colorimetry, and gas chromatography. The highest median monthly permissible dust precipitation is 15 g per sq m. The financial outlay for pollution equipment comes to approximately 10% of the initial investment in the plant.
APTIC-22504

### CONTROL OF INDUSTRIAL POLLUTION IN THE SARNIA AREA. (INDUSTRIAL PROGRESS REPORT).

For primary bibliographic entry see Field 04.
APTIC-22512

### IMPACT OF AIR POLLUTION REGULATIONS ON FUEL SELECTION FOR FEDERAL FACILITIES.

Contract CST490, TR-57, 52p., 1970.
Personal Author Not Recorded.
Identifiers: *Federal governments, *Regulations, *Fuel standards, Stack gases, Smokes, Coal resources, Natural gas, Oil resources, Steam plants, Nitrogen oxides, Sulfur oxides.

Results of a report to determine the extent to which current and anticipated air pollution regulations will restrict the types of fuel which Federal agencies will be allowed to burn in steam-power and central heating plants are described. Procedures to be used in taking account of such restrictions in economic analyses to determine the type of fuel to burn are included. Three fossil fuels- coal, oil, and gas- are evaluated regionally from the standpoint of availability, quality, and price. Types of emissions which are considered include smoke, particulates, nitrogen oxides, and sulfur oxides. Control equipment to remove sulfur oxides is not to be considered by Federal facilities unless there is no other alternative. Existing and anticipated air pollution control regulations for the nation are presented.
APTIC-22559

### THE TRANSCONTINENTAL GAS PIPE LINE CORPORATION LIQUEFIED NATURAL GAS PROJECT FOR PEAK LOAD SHAVING SERVICE TO CUSTOMER COMPANIES (LNG SYMPOSIUM).

For primary bibliographic entry see Field 02.
APTIC-22576

### CONSTRUCTION AND OPERATION OF FIRST MIDWESTERN LNG PEAK SHAVING PLANT (LNG SYMPOSIUM).

For primary bibliographic entry see Field 02.
APTIC-22577

### CONSTRUCTION AND OPERATION OF A NEW LIQUEFIED NATURAL GAS PLANT (LNG SYMPOSIUM).

For primary bibliographic entry see Field 02.
APTIC-22578

### AIR POLLUTION BY MOTOR CAR EXHAUST GASES.

For primary bibliographic entry see Field 07.
APTIC-22579

### ATMOSPHERIC AIR POLLUTION IN LITHUANIAN CITIES.

U.S.S.R. Literature on Air Pollution and Related
Occupational Diseases, vol. 8:174-179, 1963. (B. S.
Levine, ed.) CFSTI: 63-11570
P. N. Zhilin.
Identifiers: *Lithuania, *Dusts, *Industrial emission sources, *Air quality measurements, Children, Respiratory diseases, Influenza, Pneumonia, Tuberculosis, Ussr, Urban areas, Stack gases, Chemical processing, Electric power production, Paper manufacturing, Stacks, Collectors, Absorption (general), Sulfur dioxide.

Results of an investigation of the air quality of several Lithuanian cities indicate that two electric heat and power stations, a cellulose-paper combine, and a sulfate plant are major contributors to air pollution. At 100 m and 300 m from one of the two power stations, dust concentrations were, respectively, 22 times and 35 times in excess of the allowable limits. The highest dust concentrations from the other station were found at a distance of 300 m; this may be due to the fact that the station's 99-m smokestack carries the ash farther before it begins to settle. Numerous complaints were received from residents living 300-499 m from the station. Influenza, pulmonary tuberculosis, and pneumonia occur frequently among children living in the area of the 99-m stack. The present investigation also disclosed an increase in serious respiratory disturbances in children residing near the cellulose-paper combine's new acid producing plant. Sulfur dioxide emissions from this plant exceed by 10 times the allowable concentration. It is recommended that the electric power plants be equipped with dust collectors and that sulfur dioxide emissions from the cellulose-paper combine be controlled by proper absorption equipment. It is further recommended that railroad transportation be electrified and that foundries and other industries emitting dust and gases be separated from populated areas by a sanitary clearance zone.
APTIC-22591

### ATMOSPHERIC AIR POLLUTANTS DISCHARGED BY THE SHEBEKINSKII SYNTHETIC ACIDS AND ALCOHOLS PRODUCING COMBINE.

U.S.S.R. Literature on Air Pollution and Related
Occupational Diseases, vol. 8:169-173, 1963. (B. S.
Levine, ed.) CFSTI: 63-11570
F. I. Dubrovskaya.
Identifiers: *Fatty acids, *Chemical processing, *Air quality measurements, *Hydrocarbons, Seasonal, Ussr, Stack gases, Organic acids, Alcohols, Combustion.

Results of air sampling in the vicinity of a plant producing synthetic acids and alcohols indicate that the atmosphere is heavily polluted by hydrocarbons and fatty acids. Maximal single total hydrocarbon concentrations of 52.8 mg/cu m were found in air samples collected 250 m from the plant. Total fatty acid determinations were positive in 54% of the samples collected at the 250 m distance; maximal single concentrations were 56.16 mg/cu m. Fifty-one percent of the samples contained unsaturated hydrocarbons with maximal single concentrations of 13.4 mg/cu m. The maximal single concentrations of unsaturated hydrocarbons and fatty acids were higher during the spring than during summer, when emission gases were burnt. It is recommended that all emissions be thoroughly burnt and that the gas combustion furnace be protected against uncombusted gas leakage.
APTIC-22592

### AUTOMOBILES AND AIR POLLUTION.

Chicago Operations Office (AEC), Ill., Proc. Conf.
Univ., Natl. Labs., Man's Environ., Chicago, Ill.,
1969, p. 109-132. (July 27-29.) CFSTI: CONF-690705
Lawrence R. Hafstad.
Identifiers: *Automotive emissions, *Automotive emission control, Costs, Engine exhausts, Crankcase emissions, Fuel evaporation, Particulates, Smog, Smokes, Electric propulsion, Gas turbines, Internal combustion engines, Diesel engines, Spark ignition engines, Steam engines, Automobiles, Catalytic afterburners, Engine design modification, Catalytic oxidation, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Sulfur dioxide.

Automobiles and their contribution to air pollution are discussed. Automobiles emit large amounts of carbon monoxide, hydrocarbons, and nitrogen oxides. These pollutants may cause physiological and plant damage effects, photochemical smog, reduced visibility, discoloration, soiling, and corrosion. Over 100 separate hydrocarbons have been identified in the exhaust gas. Crankcase controls and other devices have reduced hydrocarbon emissions, and it is expected that by 1975 these emissions will be down to the 1940 level. It is desirable to operate engines with a lean air-to-fuel ratio to reduce hydrocarbons and CO in the exhaust. However, in this oxidizing atmosphere, nitrogen oxide emissions increase. The relative control costs of different engine plants are shown graphically. The Stirling engine, the gas turbine, and the steam car are low in hydrocarbon emissions, but high in cost. It is believed that the internal combustion engine with control devices can beequally effective. A catalytic muffler is suggested to reduced nitrogen oxides emissions. The relative advantages and disadvantages of the various types of engines are shown in tabular form.
APTIC-22599

### OZONE. A HANDBOOK OF PHYSICAL AND TECHNICAL DATA.

Ozone Research and Equipment Corp., Phoenix,
Ariz., 8p., 1961 (°).
Dale J. Milnes.
Identifiers: *Ozone, Toxicity, Measurement, Iodimetric methods, Measurement methods, Oxygen, Photochemical reactions.

The following aspects of ozone are briefly discussed: atmospheric ozone, ozone applications, environmental ozone, ozone generators (quartz mercury arc ultra-violet, silent arc discharge, and electrolytic), ozone measurement, molecular structure, solubility, and toxicity. The section on measurement includes a detailed review of the various units of measurement in which ozone concentrations are reported, and of the principles underlying the processes for conversions among these units. A table is given of the physical constants of ozone and oxygen.
APTIC-22731

### EMISSION LIMITED CITY CARS FOR METROPOLITAN AREAS.

For primary bibliographic entry see Field 02.
APTIC-22783

### HUMAN AND TRAFFIC CONTROL FACTORS IN AUTOMOTIVE EXHAUST EMISSION.

Preprint, Society of Automotive Engineers, Inc.,
New York, 9p., 1968, 25 refs. (Presented at the
Society of Automotive Engineers, Mid-Year
Meeting, Detroit, Mich., May 20-24, 1968, Paper
680398.)
Lucien Duckstein, Michael Tom, and Louin L.
Beard.
Identifiers: *Automotive emissions, *Engine operating cycles, *Vehicles, Operating variables, Automotive emission control, Mathematical modeling.

It is possible to quantify the level of air pollution caused by a given driver behavior or by simple variation of traffic flow factors. When the traffic control conditions are given, a dynamic programming algorithm yields a control policy which minimizes emission of pollutants. When the driver behavior is fixed, the pollution caused by a single vehicle for various settings can be calculated. Various combinations of acceleration, deceleration, and constant velocities can change pollutant emission in extreme cases by more than one order of magnitude. The optimal driving policy consists of accelerating at a uniform rate to some speed and maintaining that speed if possible. The corresponding cruising speed is dependent upon signal synchronization, signal spacing, speed limits, and the initial speed. Lower initial speeds tend to yield higher emission levels while higher initial speeds, those at the speed limit, yield lower emission levels. Mere inclusion of an ill-timed light in an otherwise synchronized system can raise the level of emission from about 0.005 to 0.013 lb of hydrocarbons. The amount of red time per cycle appears to be a very significant factor affecting the level of pollution. A simultaneous timing of signals along an axis can double the level of emission as compared to a progressive light system.
APTIC-22784

### EYE IRRITANTS FORMED BY THE INTERACTION OF STYRENE AND HALOGEN IN THE ATMOSPHERE.

Manufacturing Chemists Association,
Washington, D. C., Air Pollution Abatement
Committee and Manufacturing Chemists
Association, Washington, D. C., Water Pollution
Abatement Committee, Proc. Mfg. Chem. Ass.
1952-53 Pollution Abatement Conf., 6p.
E. M. Adams, and E. J. Schneider.
Identifiers: *Eye irritation, *Chemical processing, *Halogen gases, *Styrenes, Winds, Bromine, Chlorine, Hydrocarbons, Solar radiation.

Eye irritation in a large chemical plant was caused by the interaction of styrene with chlorine or bromine in the atmosphere. In one instance, when wind direction was right, styrene vapors in waste water from an ethylene-products plant reacted with air containing chlorine that had been removed from electrolytic cells used for magnesium production. In another episode, styrene emissions from a polystyrene plant reacted with free bromine coming from bromate cells. Since the irritant was catalyzed in laboratory experiments by ultraviolet radiation, it appears dependent on the presence of sunlight. Formation of the irritant was prevented by reducing loss of styrene to the sewer, cessation of styrene operations, redesigning bromate cells with provisions to scrub bromide from the exhausted air.
APTIC-22791

### ABATEMENT OF SULFUR OXIDE EMISSIONS FROM STATIONARY COMBUSTION SOURCES.

For primary bibliographic entry see Field 02.
APTIC-22800

### THE NATURE OF CHARGES FOUND IN AUTOMOBILE EXHAUST GASES.

American Inst. of Medical Climatology,
Philadelphia, Pa., Proc. Intern. Conf. Ionization
Air, Philadelphia, Pa., 1961, 1 (8):14p. 4 refs. (Oct.
16-17.)
Ralph W. Burhans, and John V. Derau.
Identifiers: *Engine exhausts, *Ions, Automotive emissions, Particulates, Engine operating cycles, Operating variables, Measurement methods, Photometric methods, Smokemeters, Fuel additives, Electric charge.

Observations on the 'natural' ion level of exhaust gases tend to support the hypothesis that the ions are largely charged particulate matter with little if any free charged molecular species. A system was designed to approximately duplicate the residence time of exhaust gas in the muffler and tailpipe of a normal road vehicle and also to dilute the raw exhaust. Oil consumption of the engine, the type of oil used, and the general condition of the engine appeared to affect the ion level to a great degree. Fuel additives increased the ion content. It was only observed qualitatively that positive ions are more prevalent during acceleration, negative ions prevail during deceleration, and positive ions prevail during engine warm-up; the latter is probably due to large amounts of water condensation droplets. The unipolar ion content of the exhaust was increased by a factor of three when high potentials were applied to the Philco ionizer. A Phoenix smoke photometer was used to evaluate particulate removal efficiency.
APTIC-22802

### HAZARDS OF LNG SPILLAGE IN MARINE TRANSPORTATION. FINAL REPORT.

For primary bibliographic entry see Field 02.
APTIC-22805

### SYSTEMS STUDY OF AIR POLLUTION FROM MUNICIPAL INCINERATION. VOLUME III. (BIBLIOGRAPHY).

Little (Arthur D.) Inc., Cambridge, Mass., NAPCA Contract CPA-22-69-23, 64p., March 1970. 544 refs. CFSTI: PB 192380
Steven H. Chansky, Anne N. Dimitriou, Edwin L. Field, Charles R. LaMantia, and Robert E. Zinn.
Identifiers: *Incineration, Costs, Solid waste disposal, Operating variables, Control equipment, Control methods, Design criteria.

A bibliography of selected references on incineration is presented as Volume III of a three volume report on air pollution from municipal incineration. The scope of the study, conclusions, and recommendations are presented in Volume I; Volume II consists of appendices to the report. Subject areas included in the bibliography include the location, number, capacity, and design characteristics of U. S. and foreign incinerators; refuse quantity and quality; emission data; effect of design and operating parameters on emissions; performance of air pollution control devices; economics of incineration; new concepts of incineration; other methods of refuse disposal; and a miscellaneous category which includes data on population, rainfall, and similar useful information. An author index is included.
APTIC-22808

### REACTIONS OF METAL NITRATES IN MOLTEN SULFUR.

South Carolina Univ., Columbia, Dept. of Chemical Engineering, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1966, 165p. 65 refs.
Samuel Lee Torrence.
Identifiers: *Nitrates, *Sulfur compounds, *Nitration, Reactors (nuclear), Sulfuric acid, Aluminum compounds, Iron compounds, Nickel compounds, Strontium compounds, Nitrogen, Nitric oxide (no), Nitrous oxide (n20), Radioactive radiation, Reaction mechanisms.

The disposal of radioactive waste products in the form of metal nitrates may be accomplished by reacting them with molten sulfur. In this process, de-nitration and dehydration occur, producing compounds of greater stability than the original one. The reactions of aluminum, iron, nickel, and strontium nitrates with molten sulfur are studied for the purpose of determining the reaction products. Nitric oxide, nitrous oxide, and nitrogen are gaseous products. No sulfur gases are found in the gas phase when water vapor is present. The combined sulfur is distributed between sulfuric acid on the walls and a solid sulfate within the molten sulfur. Analytical procedures, involving mass spectroscopy, wet chemical analyses, and equilibrium calculations are developed to describe the material balances and product distribution. (Author abstract modified)
APTIC-22814

### SPARK IGNITION ENGINE EMISSIONS AND KNOCK.

Pennsylvania State Univ., University Park, Dept. of Mechanical Engineering, NCAPC Grant AP-00560, Rept. S40, 64p., June 1970. 24 refs.
L. C. Duke, and S. S. Lestz.
Identifiers: *Knock, *Engine exhausts, *Spark ignition engines, Air-fuel ratio, Spark timing, Hydrocarbons, Carbon dioxide, Carbon monoxide, Nitric oxide (no), Pressure.

The effect of knock on exhaust emissions was examined in a single cylinder spark ignition engine. The exhaust components monitored were carbon monoxide, carbon dioxide, oxides of nitrogen as nitric oxide, and total unburned hydrocarbons. Knock was induced solely by changing the spark timing. A method to quantitatively describe knock was developed, based upon measurements of the rate-of-pressure-change irregularities occurring during the combustion process. Knock severity was measured by a 'knock intensity' scale. The use of the rate-of-pressure-change to define a quantitative knock intensity scale was supported by an apparent generalization of the stoichiometric air-fuel ratio data. Graphs are presented that indicate the dependency of power output, as well as exhaust emissions, on knock intensity for various air-fuel ratios. (Author abstract)
APTIC-22815

### CHARGE CONDITIONING EFFECTS ON CYCLE-BY-CYCLE PRESSURE DEVELOPMENT VARIATIONS OF AN SI ENGINE.

Pennsylvania State Univ., University Park, Dept. of Mechanical Engineering, NCAPC Grant AP-00560, Rept. 36, 59p., March 1970. 18 refs.
D. K. Kenemuth, and S. S. Lestz.
Identifiers: *Engine operating cycles, *Spark ignition engines, *Pressure, Carburetion.

Cycle-by-cycle variations in the pressure development of a spark ignition engine have long been known to exist; however, their cause is still uncertain. It has been hypothesized that these cycle-by-cycle pressure-development variations can be reduced by improved charge preparation. The relationship between charge conditioning and variations in cycle-by-cycle pressure development is investigated. The average peak pressure, the average peak rate of pressure change, the angle at which the average peak pressure occurred, and the angle at which the average peak rate of pressure change occurred were measured and statistically analyzed for cycle-by-cycle variations. Comparison runs were made with a direct induction system and a preconditioned charge induction system. The pressure development information for these two induction systems were statistically compared to determine if a correlation existed between charge conditioning and cycle-by cycle pressure development fluctuations. Only the angles at which the average peak pressure and the average peak rate of pressure change occurred showed significant variations between the two induction systems. For the engine conditions investigated, it was established that with a preconditioned charge, cycle-by-cycle air-fuel ratio variations can be neglected in further work dealing with pressure and rate of pressure change fluctuations. (Author abstract modified)
APTIC-22816

### SYSTEMS STUDY OF AIR POLLUTION FROM MUNICIPAL INCINERATION. VOLUME II. (APPENDICES).

For primary bibliographic entry see Field 02.
APTIC-22860

### SYSTEMS STUDY OF AIR POLLUTION FROM MUNICIPAL INCINERATION. VOLUME I.

For primary bibliographic entry see Field 02.
APTIC-22862

### NATIONAL INVENTORY OF SOURCES AND EMISSIONS. CADMIUM, NICKEL AND ASBESTOS. 1968. SECTION II. NICKEL.

NAPCA Contract CPA 22-69-131, NAPCA-APTD-69, 37p., Feb. 1970. 10 refs. CFSTI: PB 192251
Personal Author Not Recorded.
Identifiers: *Nickel, *Industrial emission sources, Coal, Fuel oils, Residual oils, Metal fabricating and finishing, Mineral processing, Primary metallurgical processing, Emission inventories, Particle size, Nickel compounds.

The flow of nickel in the U. S. is traced and charted for 1968 in mining and processing, imports and exports, nickel stocks, and reprocessing (stainless steel, alloy steel, nickel alloys, electroplating, copper base alloys, catalysts, coinage, and batteries). Consumption was 159,306 tons and domestic production 29,215 tons from primary and secondary sources, with most imports from Canada. Nickel emissions are given by source and by states, and emissions factors and brief process descriptions are given for mining and metallurgical processing, reprocessing, and consumptive uses (oil, gasoline, and coal). Based on preliminary information, the particle size of nickel oxide emissions is assumed to be 0.1 to 1 micron. Emissions to the atmosphere during the year were 6475 short tons. About 83% of the emissions were due to the burning of heavy fuel oil and coal. Estimates of emissions for mining, metallurgical processing, and reprocessing operations are based on data obtained by personal contact with processing and reprocessing companies, and are considered to be reasonably accurate. Further effort is recommended to confirm the accuracy of the emissions from the burning of residual fuel oil and coal.
APTIC-22867

### NATIONAL INVENTORY OF SOURCES AND EMISSIONS. CADMIUM, NICKEL AND ASBESTOS. 1968. SECTION I. CADMIUM.

NAPCA Contract CPA 22-69-131 NAPCA-APTD-68, 44p., Feb. 1970. 12 refs. CFSTI: PB 192250
Personal Author Not Recorded.
Identifiers: *Cadmium, *Industrial emission sources, Steel, Zinc, Metal fabricating and finishing, Mineral processing, Primary metallurgical processing, Emission inventories, Cadmium compounds.

The flow of cadmium, which is essentially a by-product of zinc smelting, is traced and charted for the year 1968 in the U. S. in mining and processing, imports and exports, and reprocessing (e.g., electroplating, pigments, plastics, alloys, and batteries). The apparent comsumption was 13.3 million lbs, and domestic production 10.6 million lbs. Only a small amount was recovered from scrap. Atmospheric emissions, emission factors, and brief process descriptions are given for areas closely related to existing or potential atmospheric losses of the pollutant. Emissions to the atmosphere during the year totaled 4.6 million lbs. Emissions from the metallurgical processing plants of the primary producers of cadmium, zinc, lead, and copper were more than 2 million lbs, and those from melting operations in the iron and steel industry were about the same. Emission estimates for mining, metallurgical processing, and reprocessing operations are based on data from production companies that represent about 40% of total production and from reprocessing companies handling about 45% of cadmium used in consumer products, and are considered reasonly accurate. Emission control equipment is in use at all the production facilities that were visited; such control is part of the process system for zinc recovery and is not specifically for control of atmospheric cadmium emissions. Further effort is recommended to confirm the accuracy of emissions from scrap containing cadmium. (Author summary modified)

APTIC-22872

**NATIONAL INVENTORY OF SOURCES AND EMISSIONS. CADMIUM, NICKEL AND ASBESTOS. 1968. SECTION III. ASBESTOS.**
NAPCA Contract CPA 22-69-131, NAPCA-APTD-70, 46p., Feb. 1970. 2 refs. CFSTI: PB 192252
Personal Author Not Recorded.
Identifiers: *Asbestos, *Industrial emission sources, Incineration, Mineral processing, Surface coating operations, Emission inventories.

The flow of asbestos in the U. S. is traced and charted for 1968 in mining and processing, imports and exports, and reprocessing (e.g., friction material, asbestos cement products, floor tile, textiles, and asbestos paper). Apparent consumption was 817,363 tons with domestic production only 120,690 tons; most imports were from Canada. There was no recovery from scrap. Emissions, emission factors, and brief process descriptions are given for mining and other basic processing, reprocessing, consumptive uses (road surfacing, construction, brake linings, steel fireproofing, motor vehicle use, and insulating cement), and incineration and other disposal. Emissions to the atmosphere during the year were 6579 tons. About 85% of the emissions were due to mining and milling operations. Estimates of emissions are based for the greatest part on observations made during field trips, and on the limited information provided by mining, milling, and reprocessing companies. Information was not available regarding the magnitude of the emissions or the particulate size. There were no emission records at any of the locations visited. An appendix gives the names and locations of industrial firms involved in asbestos processing and use.
APTIC-22873

**REVIEW OF BUREAU OF MINES COAL PROGRAM, 1967.**
Bureau of Mines Information Circ., no. 8385, 99p., June 1968. 72 refs.
John D. Spencer.
Identifiers: *Coal, *Mining, *Control methods, Costs, Humans, Occupational health, Health impairment, Pneumoconiosis, Carbon black, Stack gases, Dusts, Fly ash, Coke, Fuel gases, Electric power production, Sewage treatment, Landfills, Gas chromatography, Particle size, Stack sampling, Catalytic oxidation, Sulfur oxides control, Ventilation, Hydrocyanic acid, Arsenic compounds, Chlorine, Fluorine, Hydrogen, Nitric oxide (no), Oxygen, Catalysts, Hydrogenation.

Details of environmental studies featured in research and technological work on coal, and other research relating to the mining and utilization of coal are presented. Fly ash is evaluated for use in land reclamation and agriculture. Investigations of desulfurization methods include lime additives, centrifugation, wet tabling, and others. Programs to locate low-sulfur coal have been initiated. Sulfur dioxide recovery from stack gases is accomplished by absorption by alkalized aluminum, chromatographic sorption, manganese oxide absorption, limestone addition, catalytic oxidation, and the Reinluft process. The effectiveness of various methods for decomposing nitric oxide are tested. Costs for cleaning stack gases are estimated. Chlorine removal from gases and stack sampling methods are mentioned. The use of coal as a purification method for sewage is investigated. Studies to determine particle size ranges in mining operations are discussed. Occupational health as it relates to mining is studied. The relationship between coal dust and pneumoconiosis is studied, as well as methane-coal dust explosions. Gas chromatographic methods and ventilating systems used in mines are described. Coal processing and storing methods are discussed. Combustion research on coal as a fuel for power generation is reviewed, and catalysts for hydrogen-oxygen fuel cells are tested. Coke production represents a large market for coal. Gasification research and hydrogenation methods are disclosed. New uses for coal include the production of hydrogen cyanide, carbon black, lignite, and synthetic food for microbes. Composition and properties of coal and coal products are analyzed, and arsenic and fluorine content of coal are determined analytically.
APTIC-22875

**KEEPING THE AIR PURE.**
For primary bibliographic entry see Field 03.
APTIC-22877

**IRRADIATION OF AUTOMOBILE EXHAUST.**
Air Pollution Foundation, Los Angeles, Calif., Tech. Prog. Rept. 5, Rept. 27, 70p., March 1959. 4 refs.
W. L. Faith, N. A. Renzetti, and L. H. Rogers.
Identifiers: *Eye irritation, *Engine exhausts, *Light radiation, Aerosols, Olefins, Nitric oxide (no), Ozone.

Irradiation of automobile exhaust shows that car variables influence eye irritation as much as fuel variables. When the exhaust ratio and the automobile are adjusted to give hydrocarbon and nitric oxide concentrations in the approximate range of 2-5 ppm and 0.5-2 ppm respectively, and their ratio of concentrations is in the range of 2-8, significant eye irritation is produced with all fuels, but exhaust from the 52% olefinic fuel gives greater eye irritation. Good correlations are found between eye irritation and the concentrations of certain carbon (4) and carbon (5) olefins in the exhaust; however, other hydrocarbons do not show such correlations. Ozone concentration produced by irradiation of exhaust is independent of fuel composition; aerosol is dependent on both the olefin content and the sulfur content of the fuel. Several olefinic hydrocarbons are added to the exhaust-air mixture in the smog chamber. Eye irritation is usually increased. Two exhaust control devices that eliminated hydrocarbons are tested. Both eliminate eye irritation. (Author abstract modified)
APTIC-22880

**HUMIDITY EFFECTS ON ENGINE NITRIC OXIDE EMISSIONS AT STEADY-STATE CONDITIONS.**
Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1970. 5 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Detroit, Mich., May 18-22, 1970, Paper 700467.)
J. A. Robison.
Identifiers: *Humidity, *Nitric oxide (no), *Engine exhausts, Air-fuel ratio, Spark timing, Hydrocarbons, Carbon dioxide, Carbon monoxide, Oxygen.

Methods and results are reported of an investigation of the humidity effect on nitric oxide and NDIR (nondispersive infrared) hydrocarbon concentration, determined from engine testing at steady-state operating conditions covering a range of speeds, intake vacua, and air-fuel ratios. The humidity effects were determined with air-fuel ratio held constant and spark timing optimized to minimum-for-best-torque spark advance. Exhaust samples were analyzed for carbon dioxide, carbon monoxide, oxygen, NDIR hydrocarbon, and NO concentration by infrared and oxygen analyzers. Inlet air humidity had a significant effect on the levels of engine NO concentration at steady-state conditions. The humidity effect was a function of air-fuel ratio, observed NO concentration level, and observed humidity level. Equations and graphs were derived to adjust NO concentrations from one humidity level to another. Adjustments in NO concentration varied from 2 to 9 ppm per grain moisture change in absolute humidity. Humidity had a small effect on the combustion rate and on best power spark timing. Operation at increased humidity required greater spark advance. (Author conclusions modified)
APTIC-22888

**AIRCRAFT ENGINE EXHAUST EMISSIONS.**
Preprint, American Society of Mechanical Engineers, New York, 12p., 1969. 7 refs.
(Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, Los Angeles, Calif., Nov. 16-20, 1969, Paper 69-WA/APC-4.)
E. Karl Bastress, and Ronald S. Fletcher.
Identifiers: *Engine exhausts, *Jet aircraft, *Propeller aircraft, Airports, Particulates, Fuels, Engine operation modification, Engine design modification, Hydrocarbons, Lead compounds, Carbon monoxide, Nitrogen oxides.

A study of aircraft engine exhaust emissions is presented. Both jet and propeller type engines are considered. Aircraft are classified by operation, with appropriate emission factors assigned for different operations. Aircraft fuel characteristics are discussed, and consumption figures are presented. Emissions of concern are carbon monoxide, hydrocarbons, nitrogen oxides, and particulate matter consisting of lead compounds and carbon. Average daily emissions for air terminals are tabulated. Reduction of emissions can be accomplished through fuel modification, engine design modification, and by altering ground operations. The principal impact of aircraft emissions is local in nature and is expected to become more severe in future years.
APTIC-22890

**EFFECT OF $SO_2$ POLLUTION IN THE VICINITY OF A POWER PLANT.**
(Immissionsbeaufschlagung durch Schwefeldioxid in der Umgebung eines Kraftwerkes) Text in German. Wasser Luft Betrieb, 12 (11):705-708, 1968. 5 refs.
Hanns-Joachim Koerner.
Identifiers: *Electric power production, *Air quality measurements, *Sulfur dioxide, Germany, Stack gases, Particulates, Stacks, Photometric methods, Electrostatic precipitators, Altitude, Meteorology, Winds, Topographic interactions, Sulfur oxides, Hydrogen sulfide.

A systematic study of an area lying within a 3-mile radius of a heavy emission source is described. A network of measuring points was established, such that each square kilometer of the area would be represented. Sulfur dioxide concentrations in the atmosphere were sampled by the silica gel process from the summer of 1966 to the summer of 1967. Laboratory analysis consisted of reducing the absorbed $SO_2$ to $H_2S$ and photometrically measuring the molybdenum blue reaction. The emission source was a power plant with a total output of 128 megawatts, where a large percentage of the particulate content of the waste gases is removed with an electrostatic filter and the waste gas is released into the atmosphere from a chimney 104 meters high. The plant is at an altitude of about 150 m above sea level, 4.2 km south of the center of a large city, on the southern edge of a basin bounded by a forest-covered plateau. Meteorological data are given and discussed. The data obtained is evaluated in terms of 2 statistical functions, one representing the upper limit of the scattering range of average values (sustained load), the other the upper limit of the scattering range of individual concentrations (peak load). The effect of wind direction and wind velocity on these two emission functions is discussed.
APTIC-23356

**HIGH-TEMPERATURE COMBUSTION OF COAL SEEDED WITH POTASSIUM CARBONATE IN THE MHD GENERATION OF ELECTRIC POWER.**
For primary bibliographic entry see Field 02.
APTIC-23359

**MECHANICAL ENGINEERING PROBLEMS IN ENERGETICS/MHD.**
Preprint, American Society of Mechanical Engineers, New York, 8p., 1969. 24 refs.
(Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, Los Angeles, Calif., Nov. 16-20, 1969.)

J. B. Dicks.
Identifiers: *Magnetohydrodynamics (mhd), Costs, Combustion gases, Particulates, Nuclear power plants, Steam plants, Scrubbers, So2 removal (combustion products), Nitrogen oxides, Temperature.

Magnetohydrodynamics (MHD) power generation is compared with coal-fired and nuclear plants in terms of power production, economics, and environmental considerations. Nuclear plants are superior to either conventional steam or MHD steam plants in terms of air pollution, but only at a great increase in thermal pollution. MHD plants produce less effluent per kwh than conventional plants due to their higher thermal efficiency, and because they incorporate very efficient, economical scrubbing units. Such units remove nitrogen compounds, sulfur dioxide, and almost all particulate matter. The problem of thermal pollution as caused by power generating stations is considered. Technical problems to be solved for the application of MHD plants are discussed.
APTIC-23379

### 'FROHOLE' NEARS COMPLETION.
For primary bibliographic entry see Field 02.
APTIC-23381

### REPORT ON THE AIR POLLUTION RESEARCH OF THE INSTITUTE FOR WATER, SOIL AND AIR-HYGIENE IN THE FEDERAL HEALTH OFFICE OF THE TOWN DISTRICT OF DUISBURG DURING THE YEARS 1954/1956.
World Health Organization, Copenhagen (Denmark), Regional Office for Europe, Proc. Conf. Public Health Aspects Air Pollution Europe, Milan, Italy, 1957, p. 284-296. (Nov. 6-14.)
A. Heller.
Identifiers: *Residential areas, *Chemical processing, *Mineral processing, *Primary metallurgical processing, Proposals, Planning and zoning, Complaints, Iron, Germany, Urban areas, Stack gases, Dusts, Air quality measurements, Dispersion, Winds, Sulfur compounds.

Following complaints about air pollution from the ironworks, coal mines, and chemical plants in the town of Duisburg, dust and waste gas emissions inside and outside factories and plants were measured from 1954-1956. In 1954, 35 mg sulfur was recorded 300 m from a sulfuric acid plant and 20 mg in the vicinity of another chemical plant. By 1956, the values were lower due to more effective acid-washing processes. A comparison of the results of the interior and outdoor measurements showed that the effect of waste gas in general reaches only about 3 km downwind under normal weather conditions. However, smoke and waste gas streams in the Duisburg area are often superimposed on each other, since the plants are crowded into a narrow zone. The result is a nuisance to the population, despite numerous measures taken by the firms to control air pollution. Zoning laws are needed to prevent the construction of new factories in residential districts. Where existing plants are in close proximity to residences, the effect of emissions should be reduced by buffer strips. New residential communities should not be built in the prevailing downwind direction from industries producing smoke, dust, odors, or discharging sour gas. In some cases, the construction of tall chimneys may be required to protect the population from immoderate waste gas concentrations.
APTIC-23391

### NITROGEN-OXIDE KINETICS IN AUTO COMBUSTION PRODUCTS (INTERIM PROGRESS REPORT).
Stevens Inst. of Tech., Hoboken, N. J., Dept. of Mechanical Engineering, NAPCA Grant R01-AP-00847-01A1, S.I.T. Rept. ME-RT 70003, 25p., July 1970. 18 refs. (Presented at the Combustion Institute Western States Section Spring Meeting, Berkeley Calif., 1970 and the American Society of Mechanical Engineers Winter Meeting, New York, 1970.)
James L. Hodges, Robert F. McAlevy, III James, and H. Potter.
Identifiers: *Nitric oxide (no), *Reaction kinetics, *Engine exhausts, Spark ignition engines, Test engines, Decomposition, Pressure, Temperature.

A mechanical analog for the spark ignition engine was designed, instrumented, and tested to study the kinetics of nitric oxide formation and its decomposition. Reproducibility and flexibility of the device exceed that possible with an internal combustion engine without sacrificing the essential combustion aspects of the problem. An ultraviolet absorption technique with a photomultiplier pick-up is used to measure the nitric oxide concentration inside te analog chamber. The NO concentration shows a weak dependence on the initial temperature and pressure, and is strongly affected by changes in the equivalence ratio. The mechanism by which NO concentration freezes is not dependent upon piston motion. Time-resolved NO concentration measurements are discussed. (Author abstract modified)
APTIC-23425

### THE SO2-LOAD OF THE GREATER COLOGNE AREA FROM 1964 TO 1968.
For primary bibliographic entry see Field 04.
APTIC-23430

### THE MEASUREMENT OF SOLIDS IN FLUE GASES.
(Matning av fasta partiklar i rokgaser). Text in Swedish. VVS (J. Assoc. Heating, Ventilation, Sanit. Engrs.) (Stockholm), 60 (9):509-511, Sept. 1969. 12 refs.
Olov Larsson.
Identifiers: *Boilers, *Particulate sampling, *Stack sampling, Sweden, Stack gases, Particulates, Control equipment, Carbon dioxide, Flow rates.

Investigations indicate that available particulate measuring equipment for the determination of particulates in flue gases is error-prone in the standard measurement techniques. A minimum gas velocity of 5 m/sec is necessary to get reliable values. Discrepancies are large, and single values are not representative. Test indicate that for boilers between 200-10,000 Mcal/h, the concentration of particulate matter is about 110 mg/cu m as a mean value at standard conditions and at 10% carbon dioxide without air cleaning equipment; the concentration is about 60 mg/cu m at 10% CO2 with air cleaning equipment.
APTIC-23441

### EXPERIENCE IN COMBUSTION OF HEAVY OIL WITH LOW SULFUR CONTENT.
For primary bibliographic entry see Field 02.
APTIC-23443

### THE COMBINED POWER AND HEATING PLANTS IN THE PROSPECTIVE ENERGY COVER OF THE TOWNS.
(Kraftvarmeverken i stadernas framtida energiforsorjning). Text in Swedish. Konf. Energi Och Miljo, Kungalv, Sweden, 1969, no. 5:1-3, 1969.
Olof Blomqwist.
Identifiers: *Domestic heating, *Sweden, Costs, Urban areas, Stack gases, Sulfur dioxide.

District heating in Sweden has increased more than 600% during the last ten years, and the possibilities for a continued increase are very good. In 1969, the district heating consumption was 33 TWh/yr; for 1980 and 2000, the projections are 70 and 150 TWh/yr, respectively. District heating is of great environmental value, since it tends to decrease emissions in general and sulfur dioxide in particular. The heating costs for district heating are about 1/2 the value of individual heating.
APTIC-23444

### CONCENTRATION OF SULFATE IN AEROSOL AND FOG WATER. MEASUREMENTS OF SULFATE AND OTHER INORGANIC COMPONENTS IN FOG AND CLOUD WATER.
Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 2 (1): 96–98, 1967. Translated from Japanese. 10p.
Toshiichi Okita, Takashi Tezuka, and Hiroshi Umino.
Identifiers: *Clouds, *Sulfates, *Ph, *Fog, Japan, Mountains, Rain, Sulfur dioxide.

A series of samples of fog and cloud water were collected at Mt. Norikura, Shiobara, and Mt. Tsukuba. At Mt. Norikura, the pH of the cloud water ranged from 3.4 to 4.0, and a mixture of cloud water and rainwater from the same location had a pH of 5.5. At the other two locations, where cations such as Ca neutralized the pH, values of 5.6 were obtained. Most of the sulfur dioxide content of the aerosol was converted into sulfate.
APTIC-23449

### ON THE FORMATION OF BROWN SMOKE IN THE PROCESS OF STEEL PRODUCTION WITH OXYGEN.
(Die Entstehung von braunem Rauch bei den Stahlherstellungsverfahren mit Sauerstoff). Text in German. Neue Huette, 10 (7):391-395, July 1965. 35 refs.
Gerd Neuhof.
Identifiers: *Steel, *Smokes, *Primary metallurgical processing, Germany, Control methods.

The problems connected with the formation of 'brown smoke' in steel melting using gaseous oxygen are discussed. The origin of formation of the brown smoke of aerosol character is not fully understood. The various hypotheses and literature data on the subject are surveyed. Most often, the formation of the brown smoke is related to direct or indirect iron vaporization. Properties of the smoke are discussed as well as the factors effecting its formation; the latter includes both gas blowing conditions and composition of the iron bath. The modified method for limiting brown smoke emission by either dedusting the exhaust gases or by reducing its formation as used in various countries are surveyed.
APTIC-23458

### A STUDY OF THE EFFLUENTS FROM BACK-YARD INCINERATORS.
Preprint, Air Pollution Control Assoc., Pittsburgh, 25p., 1956. 4 refs. (Presented at the Air Pollution Control Assoc. Annual Meeting, 49th, Buffalo, N. Y., May 20-24, 1956, Paper 56-2.)
J. E. Yocom, G. M. Hein, and H. W. Nelson.
Identifiers: *Single chamber incinerators, *Non-industrial emission sources, *Aliphatic fractions, *Aromatic fractions, Stack gases, Alcohols, Ammonia, Carbonyls, Methanes, Acetylenes, Ethylene, Benzenes, Acetone, Carbon monoxide, Nitrogen oxides, Sulfides.

Back-yard incinerators are important contributors to the overall air pollution problem. Determinations of the amounts of the various materials emitted from a typical backyard incinerator, with special emphasis on the organic fraction, are made. The sample incinerator is a 6 cu ft capacity type, burning a standard charge. Sampling is done by means of a large-scale freeze-out train and evacuating vessels. Analysis of the collected samples by means of chemical and infrared absorption techniques reveal extremely complex mixtures of organic compounds. Materials identified include methanol, ethylene, acetone, methane, carbon monoxide, acetylene, propylene, carbonyl sulfide, benzene, ammonia, and oxides of nitrogen.
APTIC-23466

### METHOD OF NATURAL GAS (CH4) LIQUEFACTION.
For primary bibliographic entry see Field 02.
APTIC-23486

### THE NEW WAY OF LIFE: THE FOUNDRYMAN AND CLEAN AIR.

For primary bibliographic entry see Field 12.
APTIC-23489

### FUNCTIONAL COMPATIBILITY ANALYSIS OF AIRCRAFT-ENGINE FUEL SYSTEMS.

Preprint, Society of Automotive Engineers, Inc., New York, 14p., 1969. 3 refs. (Presented at the National Business Aircraft Meeting, Wichita, Kans., March 26-28, 1969, Paper 69308.)
Cesar Gonzalez.
Identifiers: *Fuel systems, *Aircraft, *Jet aircraft, *Propeller aircraft, *Design criteria, Gasolines, Olefins, Aromatic hydrocarbons.

Compatibility requirements between engine and airframe supply systems are discussed as related to present day piston business aircraft ranging from single engine light planes to complex turbosupercharged multiengined vehicles covering a wide range of altitudes, fuel flows, temperatures, and vapor handling requirements. Fuel systems and components are presented in order of complexity, starting with gravity feed systems typical of early light planes, and progressing into the present gravity, suction, semipressurized, and fully pressurized systems. Several component features are analyzed and their characteristics grouped in integrated systems in accord with particular applications; these components include fuel tanks and reservoirs, fuel supply, transfer, and vapor return line provisions, fuel selector valves and filters, engine fuel metering systems (float and pressure carburetors and injection systems). Possibilities for future development of aircraft and powerplant systems are discussed. Fuels used on reciprocating aviation powerplants consist of petroleum hydrocarbons with approximately a maximum of 1% of nonhydrocarbons such as sulfur compounds, gum and gum-forming compounds, water soluble compounds, sodium compounds, lead compounds, bromine compounds, and naphthenic acids. The nonhydrocarbon components introduce detrimental factors in engine service and performance, and are closely controlled by the fuel specifications. Four series of hydrocarbons with different molecular structures are blended in ordinary gasolines in nonuniform proportions dictated by locality and refining methods, and are known as paraffins, cycloparaffins, aromatics, and olefins. Paraffins are very stable and have the highest heat of combination of the series. In addition, they are clean burning and do not react with fuel system materials. The cycloparaffins exhibit identical characteristics; however, their heat of combustion is lower than that of the paraffins. Aromatics are almost as stable as the paraffins, but they evolve smoke upon burning and produce severe swelling of rubber. High solvency tendencies and the lowest heat of combustion of the series contribute to their low utilitation, but because of their excellent antiknock characteristics they are used in some aviation gasolines. Olefins are the most unstable of the series and combine easily with other materials such as chlorine, bromine, hydrochloric acid, and sulfuric acid. They also combine among themselves in the presence of air to form varnish and gum type deposits.
APTIC-23501

### FROZEN EARTH LNG STORAGE.

For primary bibliographic entry see Field 02.
APTIC-23512

### FUEL COMPOSITION AND AUTO EXHAUST.

Air Pollution Control Assoc., Los Angeles, West Coast Section, Proc. Air Pollution Control Assoc., West Coast Sect., 1st Tech. Meet., Los Angeles, Calif., 1957, p. 60-68. 7 refs. (March 25-26.)
L. M. Richards.
Identifiers: *Engine exhausts, *Fuels, *Chemical composition, Engine operating cycles, Gasolines, Automobiles, Hydrocarbons, Methanes, Acetylenes, Ethylene, Aromatic hydrocarbons, Nitrogen oxides.

The relationship between automobile exhaust composition and fuel composition was studied with three representative cars and six fuels representing a wide range of hydrocarbon composition. The fuels were 1940 and 1955 composite blend gasolines, a catalytically cracked fuel, a thermally cracked fuel, a catalytic reformate, and a nonolefinic fuel. The exhausts from a car on each fuel under each of the four different driving conditions were analyzed for 11 different constituents: methane, ethylene, acetylene, C3+ olefins, C3+ CODA (cyclic-ofelins, diolefins, and acetylenes), C3+ paraffins, cycloparaffins, aromatics, C3- hydrocarbons, total carbonyl, and nitrogen oxides. Typical results are tabulated for one car with all six gasolines and all 11 constituents and for all three cars under all driving conditions for one constituent. Exhaust fuel compositions are essentially independent of the composition of the fuel. Further support for this conclusion was obtained in a study of two possible smog-forming potentials. That is, essentially similar ozone-forming abilities and plant damaging abilities were demonstrated with diluted exhaust samples under conditions commonly used to simulate smog formation in the Los Angeles atmosphere.
APTIC-23541

### PROBLEMS OF MUNICIPAL INCINERATION.

Air Pollution Control Assoc., Los Angeles, West Coast Section, Proc. Air Pollution Control Assoc., West Coast Sect., 1st Tech. Meet., Los Angeles, Calif., 1957, p. 69-81. (March 25-26.)
Ellis E. Smauder.
Identifiers: *Incineration, *Combustion air, *Design criteria, Urban areas, Dusts, Fly ash, Collectors, Scrubbers, Air-fuel ratio.

A study of 15 municipal incinerators with rated capacities from 200-900 tons per hr and built within the last 10 years at a total cost of more than $60,000,000 revealed that none would meet full rated capacity without exceeding the most liberal fly ash and smoke abatement codes and the usual requirements of less than 3% of combustible organic matter in ash residue at the ash pit. The results can be partly attributed to batch charging systems which make it difficult to maintain a well-balanced fuel-air ratio. A well-designed municipal incinerator will incorporate methods for continuous and automatic charging of materials as received, continuous and automatic stoking, and continuous ash removal. Such provisions eliminate interference with combustion air supply and control now experienced in widely accepted designs based on batch charging and stoking. Other equipment necessary for efficient incinerator operation are induced draft systems, wet fly ash collectors, and mechanical sludge removal systems. Results of ash residue and dust loading measurements from two well-designed municipal incinerators are presented as evidence that most troublesome incinerator problems can be overcome.
APTIC-23542

### THE IMPACT OF AIR POLLUTION ON THE ENVIRONMENT.

Preprint, National Air Pollution Control Administration, Cincinnati, Ohio, Div. of Air Quality and Emission Data, 12p., 1970.
George B. Morgan, and Guntis Ozolins.
Identifiers: *Pollutants, *Sources, Asbestos, Automotive emissions, Combustion products, Particulates, Suspended particulates, Pesticides, Industrial emission sources, Non-industrial emission sources, Transportation, Automobiles, Particle size, Transport, Micrometeorology, Topographic interactions, Hydrofluoric acid, Aldehydes, Formaldehydes, Fluorides, Hydrocarbons, Ketones, Metal compounds, Lead compounds, Mercury compounds, Peroxyacetyl nitrate, Carbon monoxide, Nitric oxide (no), Nitrogen dioxide (no2), Sulfur dioxide, Ozone, Hydrogen sulfide, Photochemical reactions, Combustion, Cooling, Solar radiation.

The population of a large part of the world has been exposed to polluted air for many decades and, in some cases, centuries. Significant increases are forecast for the future. If control actions are not intensified, air pollution may increase by a factor of six to ten by the year 2000. Before any meaningful control efforts can be carried out, we must know what the ambient levels of pollution are and how they relate to levels established as causing health or economic effects. Many pollutants have always been a part of the natural atmosphere. They are now called pollutants because, with man's help, they are now excessive in quantity. Particulate pollution is the most recognized and pervasive. Its health effects are functions of both particle size and composition. Another significant effect is that, suspended in the atmosphere, particulates reflect away part of the sun's energy and could result in an over-all lowering of the earth's temperature. Gases, 90% of all pollutants, are the second class of pollutant. Examples are sulfur dioxide, nitric oxide, nitrogen dioxide, carbon monoxide, and hydrogen fluoride. A third major pollutant class is the family of hydrocarbons. These participate in photochemical reactions which result in the formation of secondary pollutants such as peroxyacyl nitrates, ozone, formaldehyde, other aldehydes, and ketones. It is from these secondary pollutants that the primary danger to both animal (including the human animal) and vegetable life arises. Numerous industrial processes and the ubiquitous automobile emit these assorted products that are a serious problem in the environment surrounding their source. Almost all human activity results in some form of air pollution, direct or indirect, particulate or gaseous. High-temperature combustion, automotive, industrial, and domestic, is the principal offender. Parameters that must be considered when evaluating effects of pollution include quantity, distribution, and environmental tolerance for pollutants, individually and in concert. Locally, micrometeorology and topography also require consideration. Of all identified pollutants, suspended particulates and sulfur dioxide have been the most extensively measured and studied. As analytical techniques become available, other pollutants will come under programmed surveillance. Among these are asbestos, mercury, lead, pesticides, fluorides, and biologically active metals. International assessment of these problems is necessary for the preservation of the biosphere.
APTIC-23561

### THE TREATMENT OF WASTE GASES IN CHEMICAL INDUSTRY.

Trans. Inst. Chem. Engrs. (London), 31 (1):26-35, 1953. 16 refs. (Presented at the Institute of Chemical Engineers, Midlands Branch Meeting, England, Jan. 31, 1953.)
W. A. Damon.
Identifiers: *Great britain, *Industrial emission sources, *Control methods, Cements, Lead, Combustion gases, Dusts, Fuels, Furnaces, Cupolas, Contact processing, Petroleum refining, Electric power production, Kilns, Mineral processing, Primary metallurgical processing, Centrifugal separators, Electrostatic precipitators, Bag filters, Scrubbers, Alkaline additives, Peter spence process (claus), Ground level, Diffusion, Winds, Temperature gradient, Turbulence (atmospheric), Fluorine compounds, Carbon disulfide, Hydrogen sulfide, Air resource management, Legislation.

Statutory control of the atmospheric pollution arising from certain industrial processes is considered, and the possible means of implementing the requirements of the Alkali Act are discussed. Processes are described in which the control of pollution is difficult, and the means adopted to mitigate their effects are explained. The rate at which a gas diffuses when travelling downwind from its point of emission depends on the turbulence of the atmosphere, and this in turn is affected by the wind speed and the temperature gradient. Calculations of Bosanquet and Sutton relating to maximum ground concentrations and

chimney discharges are cited. Cement manufacture, pollution by sulfur gases, petroleum refining, requirements for lead works, and various unregistered processes are discussed. Great difficulty has been experienced in the case of a plant for the recovery of magnesia from sea water, by reason of the discharge of a very foggy emission from the kiln chimneys. The discharge of fluorine compounds, coal combustion, pollution by coke ovens, and burning spoilbanks are also considered.
APTIC-23562

### STORING LIQUEFIED HYDROCARBON GASES WITHIN FROZEN SOIL.

For primary bibliographic entry see Field 02.
APTIC-23572

### FLUORINE DAMAGE IN THE LOWER FRICK VALLEY.

For primary bibliographic entry see Field 08.
APTIC-23580

### A NEW APPROACH TO INDUSTRIAL AIR POLLUTION CONTROL.

For primary bibliographic entry see Field 02.
APTIC-23584

### NEW BATTERIES USE ZINC-AIR COUPLE.

For primary bibliographic entry see Field 02.
APTIC-23593

### SURFACE STRUCTURE OF WHEAT AND ITS CONTRIBUTION TO THE DUST PROBLEM.

Cereal Sci Today, 15 (8):230-239, Aug. 1970. 7 refs.
D. H. Simmonds, M. S. St. Clair, and J. D. Collins.
Identifiers: *Wheat, *Dusts, *Surface properties, Australia, Grain processing, Electron microscopy, Microscopy.

With optical and scanning electron microscopy, a study was undertaken to confirm the nature of the dust which arises during the handling of wheat, and to discover its origin with a view to suggesting means for its reduction or elimination. Examination under the optical microscope at 188 magnifications revealed that the dust consisted of approximately equal amounts of pericarp fragments and bristles from the brush end of the grain. Material abraded from the ridges of the surface striations probably contributes to the fine pericarp dust observed. As seen under the scanning electron microscope, approximately half of the dust produced from the samples of wheat examined consisted of epidermal hairs, at least 90% of which has fractured in the region where the protrusion and the basal portion of the cell meet. The remaining portion of the hair contribution consists of complete epidermal hair cells which have become dislodged, and of large areas of the brush portion of the grain carrying a number of hairs. Another source of dust is fragments of the pericarp dislodged by severe impact damage.
APTIC-23595

### POWER WITHOUT POLLUTION.

For primary bibliographic entry see Field 02.
APTIC-23603

### ENVIRONMENTAL SIDE EFFECTS OF ENERGY PRODUCTION.

Bull. At. Sci., 26 (8):39-41, Oct. 1970.
Donald F. Anthrop.
Identifiers: *Trends, *Electric power production, Socio-economic factors, Fuels, Nuclear power plants, Steam plants, Water pollution, Carbon dioxide, Thermal radiation.

Construction of power plants with capacities of a 2300 MWe magnitude has serious implications for the ecology of the freshwater or marine systems in which the waste heat is disposed. Fossil fuel steam generating plants convert only 30-35% of the total thermal energy into electricity, while the remaining 65-70% must be dissipated, usually in a body of water. Nuclear plants are considerably less efficient and are unlikely to match the efficiency of fossil fuel plants within the next 20 years. Although the Navajo plant will use cooling towers, this technique will result in the evaporation of about 30,000 acre-feet of water annually in a region that already suffers a chronic water shortage. Electrical energy production in the U. S. increased from 180 billion kilowatt hours in 1940 to 1433 billion kwh in 1968. Looking then to the year 2000, the waste heat that would result from the production of 11.0 trillion kwh of electrical energy would be sufficient to raise the temperature of the total annual freshwater runoff from the conterminous U. S. by 24 F. Nuclear power generation offers the possibility of providing very large quantities of energy without increasing the carbon dioxide content of the earth's atmosphere, but it is beset with many difficulties. Burner reactors consume uranium-235, and if energy consumption continues to increase as projected, low-cost uranium resources could be exhausted within half a century. Although breeder reactors would enormously increase the nuclear fuels available for energy production by converting nonfissionable uranium-238 to fissionable plutonium-239, or by converting nonfissionable thorium-232 to fissionable uranium-233, some 65 such facilities would be required and the magnitude of thermal pollution would even be greater. To a considerable extent, energy can be converted into other resources. Also, any program to control energy consumption must also have as its goal the termination of population growth.
APTIC-23619

### AUTO EXHAUST, POLLUTION AND WEATHER PATTERNS.

For primary bibliographic entry see Field 05.
APTIC-23620

### SOME COMPARISONS OF THE ENVIRONMENTAL RISKS FROM NUCLEAR AND FOSSIL FUELED POWER PLANTS.

Brookhaven National Lab., Upton, N. Y., Health Physics Div., 17p., 1970. 16 refs. CFSTI: BNL-14412
Andrew P. Hull.
Identifiers: *Nuclear power plants, *Steam plants, Particulates, Fuels, Water pollution, Radioactive radiation.

A comparison is made of the relative risk of pollution from the operation of nuclear and fossil fueled electric power plants. Consideration is given to air and water pollution by effluents, heat, and radioactivity. The possible effects on human life and health are considered, both from the possible pollution and from catastrophic accident. With regard to routine effluents, nuclear plants produce far less air pollution than their fossil fueled counterparts. The concentrations of radioactivity in their liquid effluents are controllable at levels well below radiation protection standards, and pose no threat to the environment. Contemporary nuclear plants are somewhat less thermally efficient than modern fossil plants, but the immediate waste heat problem appears manageable without causing serious environmental problems in a large body of water. Nuclear plants now being designed and tested promise to be as efficient as fossil plants.
APTIC-23652

### LEAD ISOTOPES IN GASOLINE AND AEROSOLS OF LOS ANGELES BASIN, CALIFORNIA.

Science, vol. 147:502-503, Jan. 29, 1965. 10 refs.
Tsaihwa J. Chow, and M. S. Johnstone.
Identifiers: *Los angeles, *Gasolines, *Lead compounds, *Isotopes, Non-urban areas, Urban areas, Aerosols, Air quality measurements, Fuel additives, Mass spectrometry, Snow, Tetraethyl lead.

The isotopic composition of lead isolated from antiknock gasolines and the aerosols of the Los Angeles basin was determined. By refluxing with concentrated hydrochloric acid for several hours, lead in the gasoline and in the air filtrate was extracted, and then isolated and purified by dithizone extraction. Mass spectrometric analyses were then performed. Comparison indicates that these two kinds of lead are identical within the limits of measurement error, and represent a typical 'tertiary' age lead which is less radiogenic than that of the common 'modern' lead. The isotopic composition of lead in the 1963 winter rural snow is also similar to that of the Los Angeles basin aerosols; the difference between the rural snow and the aerosols with respect to the ratio of Pb-206 to Pb-207 was about 0.8%. Contamination from the leaded gasoline alone at Lassen Volcanic National Park is calculated to be 1.1 micrograms per kilogram of precipitation. Since the advent of antiknock gasoline in 1923, more than 2.6 times 10 to the 12th power grams of lead in the form of lead alkyls have been marketed and combusted.
APTIC-23658

### EXHAUST EMISSIONS FROM WILLIAMS RESEARCH CORPORATION GAS TURBINE ENGINES. (INTERIM REPORT).

NAPCA Contract CPA 22-69-84, Rept. WR-ER8, 95p., June 18, 1970. 8 refs. CFSTI: PB 193479
Personal Author Not Recorded.
Identifiers: *Engine exhausts, *Gas turbines, Particulates, Air-fuel ratio, Hydrocarbons, Carbon dioxide, Carbon monoxide, Nitrogen oxides.

The exhaust emissions of several different models of gas turbine engines under development or in production at Williams Research Corporation were measured with respect to carbon dioxide, carbon monoxide, unburned hydrocarbons, and the oxides of nitrogen. An attempt was made to measure particulates present in the exhaust, but the concentrations were too low for the method used. The results are presented in a generalized form relating emissions to fuel air ratio and engine power or thrust. Techniques were developed to convey exhaust samples from engines in test cells to analysis equipment located elsewhere. Measurements were also made of the emissions from a gas turbine engine installed in a vehicle. It was concluded that gas turbine engines are inherently low polluters in carbon monoxide and unburned hydrocarbons compared to other types of engines of the same power output. Transient engine operation produces many times the CO and hydrocarbon emission that steady state operation produces. Part load engine operation produces more CO and hydrocarbon emission than full load. The opposite is true of the oxides of nitrogen. The oxides of nitrogen are the most serious emission problem of gas turbine engines with respect to proposed emission controls. Satisfactory methods have been developed in this program for sampling exhaust pollutants from a variety of gas turbine engines. A heated sampling system is necessary to prevent deterioration of the unburned hydrocarbon sample between engine and analyzer.
APTIC-23679

### BACTERIAL AIR POLLUTION ASSOCIATED WITH THE SEWAGE TREATMENT PROCESS.

Florida Univ., Gainesville, Coll. of Engineering, Thesis (M.S.), Aug. 1958, 64p. 38 refs.
Clinton Ronald Albrecht.
Identifiers: *Bacteria, *Sewage treatment, *Particulate sampling, Dusts, Droplets, Cascade samplers, Impingers, Centrifugal separators, Calibration methods, Dispersion, Winds, Humidity, Temperature (atmospheric).

The bacterial contamination of the air by sewage treatment plants is examined. Early types of collection devices and samplers are compared. Theoretical considerations regarding bacterial environments, sources, and concentration are given. Bacteria present in the atmsophere exist in the form of dusts, droplets, and droplet nuclei. The influences of temperature and humidity are discussed. A description of a trickling filter-type

sewage treatment plant is provided. Sampling mechanisms include the Andersen sampler, midget impinger, and Wells air centrifuge. The culture media and experimental procedures are described. The ventilation of trickling filters is related to the existence and extent of air-borne bacteria. The wind plays an important role in the distance the bacteria are spread. Calibration of bacterial aerosol sampling instruments requires carefully designed equipment.
APTIC-23680

### SULFUR OXIDES AND OTHER SULFUR COMPOUNDS. A BIBLIOGRAPHY WITH ABSTRACTS.

For primary bibliographic entry see Field 07.
APTIC-23684

### MINED CAVERNS NIXED AS LNG STORAGE UNITS.

For primary bibliographic entry see Field 02.
APTIC-23709

### NEW DESIGN OF EVAPORATOR UNITS FOR CANVEY ISLAND METHANE TERMINAL.

For primary bibliographic entry see Field 02.
APTIC-23710

### CRC AIRCRAFT ENGINE EXHAUST TESTS 1967.

Proj. CA-41-65, Rept. 422, 30p., June 1969. 5 refs.
Personal Author Not Recorded.
Identifiers: *Engine exhausts, *Jet aircraft, *Gas turbines, Smokes, Ringelmann chart, Hydrocarbons, Nitrogen oxides.

Exhaust emission measurements were made using three aircraft gas turbine engines mounted on test beds. The gas turbine engines tested included a Pratt and Whitney Aircraft JT8D-1; Pratt and Whitney Aircraft JT4A-11; and General Electric CJ805-3. Under takeoff and cruise operating conditions, the hydrocarbon emissions determined by flame ionization detection were all below 15 ppm C. Where C is the average number of atoms per molecule of hydrocarbon in the sample.) Under idle conditions, concentrations range from 126 to 242 ppm C. Concentrations of oxides of nitrogen range from 2 to 105 ppm for all operating conditions. Due to physical failure of the heated sampling line, the samples for these analyses were of necessity taken through an unheated line; this may have caused measurement errors of unknown magnitude. Smoke measurements on the exhaust gases were made using a Pratt and Whitney Aircraft modified Von Brand meter and a General Electric Spotmeter, both instruments being representative of current smoke filtering techniques. Visual ratings of the plume from the test cell exhaust stack were also made in terms of Ringelmann number. The smoke measurements obtained using the two meter methods showed good agreement with each other. The results further indicate that the meter methods appear to be more reliable than visual methods, such as Ringelmann, in establishing the smoking level of an aircraft gas turbine engine. The engines sampled represent only one engine of each type, and it is known that a range of smoke emissions occurs for any engine type. Therefore, no comparisons should be made among the engines tested which might suggest that one engine produces more or less smoke than another. The average smoke density of any given engine design can be established only by testing a number of units. (Author summary modified)
APTIC-23713

### COAL AND CLEAN AIR.

Preprint, Society of Automotive Engineers, Inc., New York, 7p., 1970. (Presented at the Society of Automotive Engineers, Inc., New York, (Presented at the Society of Automotive Engineers, Earthmoving Industry Conference, Peoria, Ill., April 14-15, 1970, Paper 700552.)
George W. Land.
Identifiers: *Combustion products, *Fuels, *Coal, Smog, Natrual gas, Fuel oils, Steam plants, Statistical analyses, Hydrocarbons, Nitrogen oxides, Sulfur oxides.

Data on fossil fuel energy (coal, petroleum, natural gas) consumed in the U. S. since 1920 are presented to show that the increase in air pollution in recent years is not from coal, which has remained relatively constant on the average in quantities used. Evidence is also presented showing that less than 20% of the pollutants emitted into the air in a typical year arises from generation of electricity and space heating, the principal uses for coal. The combustion of coal produces solid and gaseous pollutants; almost complete control of particulates is technically and economically feasible, while control of gases, mainly oxides of sulfur and nitrogen, is much less advanced. Thus, low-sulfur fuels must be used; however, because of the shortage of low-sulfur coal in some areas (mainly the Midwest), gas or low sulfur oils are substituted. Increases in gaseous pollutants in the last 50 years are attributed to increased use of natural gas and petroleum, and it is concluded that the nitrogen oxides and hydrocarbons together deserve much more control effort and research funds than they have received in comparison to sulfur dioxide, especially in view of their role in smog formation.
APTIC-23726

### AIR POLLUTION AND CONSTRUCTION EQUIPMENT.

For primary bibliographic entry see Field 11.
APTIC-23727

### TENNESSEE GAS BUILDS IN-GROUND STORAGE FOR 1-MILLION BARRELS OF LNG.

For primary bibliographic entry see Field 02.
APTIC-23733

### REPORT OF THE SWISS LEADED GASOLINE COMMISSION TO THE FEDERAL COUNCIL ON ITS ACTIVITIES DURING THE PERIOD 1947-1960.

For primary bibliographic entry see Field 07.
APTIC-23741

### EMISSIONS OF AIR CONTAMINANTS FROM BOILERS AND PROCESS HEATERS.

Los Angeles County Air Pollution Control District, Calif., California Dept. of Public Health, Berkeley, Public Health Services, Washington, D. C., Community Air Pollution Program, Western Oil and Gas Assoc., Los Angeles, Calif., Air Pollution Control Committee, Rept. 7, 29p., June 1958. 9 refs.
Howard Devorkin, and Bernard J. Steigerwald.
Identifiers: *Stack gases, *Boilers, *Petroleum refining, Particulates, Natural gas, Fuel oils, Stacks, Chemical composition, Stack sampling, Air-fuel ratio, Acetic acid, Aldehydes, Ammonia, Hexanes, Nitrogen dioxide (no2), Sulfur dioxide, Sulfur trioxide, Combustion, Temperature.

Combustion of fuel oil and gas is a source of emissions to the atmosphere. The techniques and results of a stack sampling study to determine the extent of these emissions from combustion in oil refinery boilers and heaters in Los Angeles County are presented. A total of 21 stacks were sampled, using standard sampling procedures and methods. The results were evaluated in the form of total emissions and average emission factors. The average emission factors per unit of fuel used were calculated for each contaminant for combustion of both oil and gas. The contaminants measured include hydrocarbons, as hexane; sulfur dioxide; oxides of nitrogen, as nitrogen dioxide; particulate matter; sulfur trioxide; ammonia; aldehydes; and organic acids, as ascetic acid. Emissions of sulfur oxides are a direct function of the composition of the fuel, while the emission of the other contaminants are primarily influenced by combustion temperature, heater design, or air-fuel ratio rather than fuel composition. Comparison of the analysis of stack gases for SO3 with the measured SO2 emissions from these units gave an average ratio of SO3 to total sulfur as SO2 of 0.03. Of the 20 tests made for CO, 14 were negative, five showed a trace less than 0.001%, and one showed a concentration of 0.003%; the emission of CO from boilers and process heaters was negligible.
APTIC-23745

### NATURAL WATER SURFACES AS A SOURCE OF AIRBORNE INFECTION AND POLLUTION.

In: Structure and Modification of Clouds and Fogs. State Univ. of New York, Albany, Research Foundation, OAR Contract F19628-68-C-0057, Proj. 7922, Task 792201, AFCRL-69-0513, Annual Summary Rept. 2, p. 153-161 Oct. 1969. 8 refs.
CFSTI, DDC: AD 707507
Duncan C. Blanchard, and Lawrence Syzdek.
Identifiers: *Bacteria, *Transport, *Water, Water pollution.

Laboratory experiments were conducted to determine whether water-to-air transfer of bacteria (both infectious and noninfectious) takes place and, if so, whether the droplets that carry bacteria to the air have a higher concentration of bacteria per unit volume than the water from which they come. Bacteria-containing jet drops were obtained by bursting aerosols that had been produced by bubbling solutions with known concentrations of bacteria. Recovery of the bacteria in the airborne jet drops demonstrated that bacteria can be transferred from water to air in significant numbers by bubbles bursting at a water surface. The number of bacteria per each drop was determined by marking impaction spots for many drops, while the volume of a drop was determined by comparing the diameter of the crater formed by drop impaction with the diameter of the drop. For each experiment, the concentration of bacteria in a drop, as computed from drop volume and number of bacteria, was higher than the concentration of bacteria in the bulk solution. In some experiments, the increase in bacteria concentration of the jet drops appeared to be a function of time. If they occur at the surface of polluted rivers and ponds, bacteria transfer processes could be an important source of biological pollution of the atmosphere.
APTIC-23748

### U. S. ENERGY SOURCES IN THE EARLY SEVENTIES.

Lawrence (Cyrus J.) and Sons, New York, Research Dept., 9p., July 23, 1970.
Charles T. Maxwell.
Identifiers: *Trends, *Fuels, *Electric power production, Socio-economic factors, Coal, Natural gas, Fuel oils, Distillate oils, Residual oils, Nuclear power plants.

A new projection of U. S. energy production for the first five years of the 1970's, which assumes that energy will equal Gross National Product increases of 4.5% annually, foresees a restructuring of energy sources, which, unlike earlier predictions, includes a cutback in coal and gas and an advance of oil into the gap. The slower pace of natural gas production is attributed in part to lack of exploration and development of reserves due to federal regulation, while coal has financial, labor, transportation, and pollution problems which could restrict the industry to gains below the potential demand for the fuel. Despite its very rapid growth, nuclear energy is not expected to make an impression on the power 'shortfall' until the late seventies. Thus oil remains the only fuel source capable of being efficiently expanded in the near term to make up the gap; an overall oil growth of over 5% per year is predicted. Heavy oils can be desulfurized to meet tight pollution standards prior to burning, generally at an economic price. Most of the demand growth will be in two product classes, distillates and residual fuel oil, the latter to replace short gas and coal supplies in the elec-

tric power generation market. The effects of these changes on the profits of the oil industry are considered. It is noted that most of the low-sulfur No. 6 fuel oil imported into the U. S. is from four Caribbean refineries, where major desulfurization facilties are located.
APTIC-23753

### SOOT FORMATION IN PREMIXED HYDROCARBON FLAMES.

(Russbildung in vorgemischten
Kohlenwasserstoff-Flammen). Text in German.
Angew. Chem., 80 (11):425-438, June 1968. 73 refs.
K. H. Homann.
Identifiers: *Soot, *Hydrocarbons, *Combustion, Germeny, Engine exhausts, Diesel engines, Air-fuel ratio, Aliphatic hydrocarbons, Butanes, Cyclic alkanes, Pentanes, Propanes, Aromatic hydrocarbons, Xylenes, Barium compounds, Carbon dioxide, Sulfur trioxide, Decomposition, Oxidation, Ionization, Particle growth, Electrical properties, Pressure, Temperature.

The effect of the fuel-oxygen ratio in ethane, propane, n-butane, n-pentane, n-hexadecane, cyclohexane, xylol and in other hydrocarbons and the dependance of soot formation on pressure and temperature and on form and structure of the flame were investigated. Unsaturated compounds formed in hydrocarbon flames from whose concentration profiles conclusions could be drawn about the quantity of generated soot. The growth of soot particles proceeds in two steps: one occurs in the oxidation zone, the other is a much longer lasting phase of thermal decomposition which reaches spatially far into the burned gas. Various hypotheses or models of soot formation were proposed; while no single mechanism can be postulated, the probable course of soot formation in premixed flames of lower hydrocarbons is outlined which is consistent with quantitative measurements. The decrease of the quantity of soot with increasing temperature is due to the reactions of the OH- radical and the formation of water and carbon dioxide. Also electric fields have a decided effect on both diffusion as well as on premixed flames due to the effect of the electric field on chemoionization. Many substances affect soot formation: thus barium salts of organic acids decrease soot formation in diesel motors, while sulfur trioxide and halogens intensify soot formation. The mechanisms of these phenomena are not understood.
APTIC-23775

### COMPARATIVE EMISSIONS FROM SOME LEADED AND PROTOTYPE LEAD-FREE AUTOMOBILE FUELS.

For primary bibliographic entry see Field 02.
APTIC-23789

### MUFFLER.

For primary bibliographic entry see Field 02.
APTIC-23814

### METHOD AND APPARATUS FOR COOLING AND PURIFYING GASEOUS PRODUCTS OF COMBUSTION.

For primary bibliographic entry see Field 02.
APTIC-23815

### POST-COMBUSTION PURIFIER FOR THERMAL ENGINES.

For primary bibliographic entry see Field 02.
APTIC-23818

### SELECTED BIBLIOGRAPHIES ON VEHICLE NOISE AND FUMES.

Bibliography 22, 10p., 1958. 76 refs.
Personal Author Not Recorded.
Identifiers: *Fumes, *Vehicles.

Forty-two selected citations on vehicle noise and 34 on vehicle fumes are listed. The references cover both general and technical aspects of these problems, and were almost all published within the period 1951-1957. The recent background of industry and public concern on these subjects is briefly described.
APTIC-23858

### THE OCEANIC PRODUCTION RATE OF CLOUD NUCLEI.

J. Rech. Atmospheriques, 4 (1):1-6, Jan.-March
1969. 11 refs.
Duncan C. Blanchard.
Identifiers: *Oceans, *Nucleation, Sea salts.

Measurements of nucleus production in the surf zone along the shore on the island of Hawaii, and the observed nucleus counts in marine air are used to estimate the oceanic generation of cloud nuclei, which is determined to be in the range of 25-100/(sq cm) (s). This figure is only 5-20% of that estimated by Squires to be produced naturally by land sources, but it appears to be sufficient to account for the cloud nuclei found in marine air far from land. (Author abstract modified)
APTIC-23859

### DISPOSAL OF WASTE MATERIALS INCIDENTAL TO THE CLEARANCE AND DEVELOPMENT OF LAND FOR SUBDIVISION OR BUILDING PURPOSES.

Bay Area Air Pollution Control District, San
Francisco, Calif., 10p., March 17, 1958.
Benjamin Linsky.
Identifiers: *Solid waste disposal, *Costs, *Trees, Portable, California, Open burning, Dumps, Scrap yards, Multiple chamber incinerators.

Disposal methods for waste materials accumulated by clearing land, such as trees and shrubs, are discussed. Since the open burning of such materials is prohibited, the methods suggested are dumps, incineration in portable multiple chamber units, chipping, using for firewood, or using the intact trees as raw materials. The costs involved in each of these methods are enumerated. No single disposal method can be recommended as the optimum solution to highly individual problems. It is probable that the added incentive of recognized disposal costs will lead to further development of uses for materials presently being wasted.
APTIC-23860

### FLUORIDES AND CHLORIDES IN PRECIPITATION SAMPLES IN BOHEMIA.

For primary bibliographic entry see Field 04.
APTIC-23862

### EVALUATION OF POLLUTION EMISSIONS IN ITALY.

(Valutazione delle effluenze inquinanti in Italia).
Text in Italian. In: L'inquinamento atmosferico in
Italia. Rept. 27, p. 70-95, 1970. 110 refs.
Luigi Mammarella.
Identifiers: *Air pollution forecasting, *Italy, Cements, Urban areas, Aerosols, Fuels, Petroleum refining, Incineration, Mineral processing, Automobiles, Statistical analyses, Nitric acid, Sulfuric acid, Aldehydes, Ammonia, Fluorine compounds, Carbon dioxide, Nitrogen dioxide (no2), Sulfur dioxide, Hydrogen sulfide.

An attempt is made to estimate the development of the pollution problem in the near future on the basis of current statistics. Figures are given on the responsibility of the main sources of pollution for the various types of pollutants found in the atmosphere. The emission of materials related to air pollution is given for six of the main industrial sources and for 4 types of fuel used. Meteorological conditions are summarized for 7 important areas of Italy: Turin, Milan, Venice, Bologna, Rome, Naples and Taranto. This is correlated with the consumption of fuel oil and gasoline, and a hypothesis is worked out for predicting possible pollution levels up to the year 1980. It is estimated that in the period 1970-1980, one could expect an average annual increase for all types of pollutants of 6.7%.
APTIC-23865

### PRINCIPLE SOURCES OF POLLUTION.

For primary bibliographic entry see Field 04.
APTIC-23881

### ON THE CONTENT OF 3,4-BENZOPYRENE IN THE EXHAUST FUMES OF DOMESTIC STOVES WITH SOLID FUEL.

(Ueber den Gehalt an 3,4-Benzpyren in den
Abgasen von Hausbrandoefen mit festen
Brennstoffen). Text in German. Staub,
Reinhaltung Luft, 30 (8):334-336, Aug. 1970. 24
refs.
Helmut Beine.
Identifiers: *Combustion gases, *Domestic heating, *Benzo (3-4)pyrene, Germany, Coal, Gas chromatography, Thin-layer chromatography, Particle size, Firing methods, Ultraviolet spectrometry.

The content of 3,4-benzopyrene was determined for emissions from different types of domestic stoves in which various qualities of coal are burnt. The methods used were gas chromatography or thin-layer chromatography, and ultraviolet spectroscopy. The 3,4-benzopyrene emission is particularly high in the case of nut-size anthracite briquettes burnt in complete combustion stoves and bottom firing stoves, that is, it lies between 370 and 380 mg/kg of coal. These high 3,4-benzopyrene emissions can be reduced to 2,2 mg/kg of coal by the use of a universal continuous burner.
APTIC-23884

### CALCULATION OF THE FREQUENCY DISTRIBUTION OF NOXIOUS GAS CONCENTRATION IN THE SURROUNDINGS OF SINGLE SOURCES.

For primary bibliographic entry see Field 05.
APTIC-23899

### THE ZINC-AIR BATTERY SYSTEM.

For primary bibliographic entry see Field 02.
APTIC-23920

### SUPER FLYWHEEL TO POWER ZERO-EMISSION CAR.

For primary bibliographic entry see Field 02.
APTIC-23921

### COMPRESSED NATURAL GAS: ANOTHER CLEAN-AIR FUEL.

For primary bibliographic entry see Field 02.
APTIC-23924

### WISHART'S POLLUTION-REDUCIN' SPLIT-CYCLE ENGINE.

For primary bibliographic entry see Field 02.
APTIC-23925

### CONCEPTUAL DESIGN. RANKINE-CYCLE POWER SYSTEM WITH ORGANIC WORKING FLUID AND RECIPROCATING ENGINE FOR PASSENGER VEHICLES.

For primary bibliographic entry see Field 02.
APTIC-23946

### A POLLUTION-FREE HYBRID FOSSIL-NUCLEAR FUELED MHD POWER CYCLE.

For primary bibliographic entry see Field 02.
APTIC-23954

### STUDY OF UNCONVENTIONAL THERMAL, MECHANICAL, AND NUCLEAR LOW-POLLUTION-POTENTIAL POWER SOURCES FOR URBAN VEHICLES.

For primary bibliographic entry see Field 02.
APTIC-23958

### THE ROLE OF CHEMISTRY IN GAS TURBINE EMISSIONS.

Preprint, American Society of Mechanical Engineers, New York, 12p., 1970. 22 refs.
(Presented at the American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, Brussels, Belgium, May 24-28, 1970, Paper 70-GT-81.)
E. S. Starkman, Y. Mizutani, R. F. Sawyer, and D. P. Teixeira.
Identifiers: *Combustion gases, *Gas turbines, *Reaction kinetics, Sampling probes, Air-fuel ratio, Hydrocarbons, Carbon dioxide, Carbon monoxide, Combustion, Thermodynamics, Temperature.

An analysis is reported of data from a laboratory model 'can-type' combustor, in order to assess the influence of thermochemical and chemical kinetic factors in the formation and declination of potential air pollutants from gas turbines. Investigations were made at 1.5 atmospheres pressure absolute and a constant fuel supply pressure. Air flow rate was varied to obtain the desired fuel-air ratios. A water cooled probe was used for sampling combustion gas. Temperature and fuel-air equivalence ratios were inferred from gas composition, and calculations were made with a digital computer of the extent of reaction completeness and complete reaction equilibrium point gas composition. Carbon monoxide reaches local peak values of 1 to 4% in the combustor, in rich mixture zones, and at temperatures less than the maximum attained. The maximum local concentrations appear to exceed calculated equilibrium by from 1 to 4 orders of magnitude. Nitric oxide reaches peak local values in zones of highest temperature and slightly lean mixture. Maximum concentrations are in the 40 to 100 ppm range. Unburned hydrocarbon progressively decreases as the burned mixture travels through the combustor. The sustained higher temperatures at larger mixtures result in ultimately lower exit concentrations. Both forward and reverse reactions appear important in determining local and exit nitric oxide concentrations. Application of observations from this and future similar studies, incorporating the influence of chemical reaction rates and chemical stoichiometry, should result in engines which produce minimal quantities of carbon monoxide, oxides of nitrogen, and unburned hydrocarbons. (Author conclusions modified)
APTIC-23966

### RECOVERY OF SULFUR DIOXIDE FROM WASTE GASES BY MEANS OF CYCLICAL KETONES I.

For primary bibliographic entry see Field 02.
APTIC-23972

### WASTE HEAT BOILER IN CONVERTER PLANTS.

(Abhitzekessel in Konverteranlagen). Text in German. Tech. Ueberwach. (Duesseldorf), 9 (11):361-364, Nov. 1968.
Georg Rump, and Alfred Kunst.
Identifiers: *Design criteria, *Boilers, *Bessemer converters, Steel, Germany, Fuel gases, Blast furnaces, Primary metallurgical processing, Safety equipment, Cooling, Heat capacity, Pressure, Temperature, Vapor pressure.

Waste gases emanating from steel converters which have a temperature of 1700 C must be cooled before dust can be removed from them. The construction of waste heat boilers which serve this purpose, waste heat utilization, dust removal, the calculation of heat supply and of steaming capacity and safety and measuring devices are described. Heat is supplied to converter waste heat boilers only during the air blast periods; they thus operate under different conditions than normally fired steam boilers. Safety valves must be calculated for maximum steam pressures generated under the most unfavorable conditions. The boiler drum must be calculated for all water volume fluctuations from beginning to end of air blasting. All safety devices must be calculated to handle maximum steam pressures, maximum carbon burning velocity, the shortest possible blast time, and the shortest possible charge time.
APTIC-23977

### STOCK PILE NATURAL GAS.

For primary bibliographic entry see Field 02.
APTIC-23991

### DETECTION AND CHARACTERIZATION OF SURFACE-ACTIVE MATERIAL IN THE MARINE ATMOSPHERE. (INTERIM REPORT).

Naval Research Lab., Washington, D. C., Ocean Sciences Div., NRL Problem G02-03, Proj. RR 104-03-41-5052, NRL Rept. 7079, 9p., May 26, 1970. 17 refs. NTIS, DDC: AD 707713
W. R. Barger, and W. D. Garrett.
Identifiers: *Oceans, *Chemical composition, *Surfactants, Particulates, Sprays, Gas chromatography, Sampling methods, Samplers, Hi-vol samplers, Fog, Haze, Hydrocarbons.

The chemical features and sources of marine atmospheric material were studied and the possibility of fog stabilization by naturally occurring surface-active material was investigated. Organic constituents of the marine atmosphere were collected on shallow trays exposed to onshore winds on the windward coast of the Island of Oahu. Upon addition of distilled water to the trays, the collected materials formed monomolecular films on the water surface, and film pressure-vs-area curves for these films were determined at the field site. The monolayer studies indicated the presence of weakly surface-active organic compounds and hydrocarbons, as well as strongly adsorbed, highly polar species. Simultaneous collections of oceanic particulate matter were made with a high-volume air sampler using glass fiber filters. The organic material was extracted from the filters with chloroform and anlyzed for specific fatty acids by gas chromatography. The ratios of the quantities of the principal fatty acids found in the air samples were similar to previously reported fatty acid ratios from sea surface samples which had been collected at the air/sea interface. It was concluded that the ocean appears to be a major source of airborne maritime organic matter, although continental contributions are possible. The implications of these data to sea fog and haze stabilization are considered. It is suggested that monomolecular films composed of the mixed surface-active material detected in marine air would not retard evaporation of spray or fog drops, although a small quantity of water might remain physically trapped by thick film segments of the remaining organic matrix. (Author abstract modified)
APTIC-24000

### DUSTS AND SMOKES IN FLUE GASES.

Brit. Coal. Util. Res. Assoc. Monthly Bull., 10 (3):61-70, March 1946. 98 refs.
G. A. Cave.
Identifiers: *Stack gases, *Dusts, *Smokes, Deposition, Materials deterioration, Corrosion, Great britain, Ashes, Boilers, Coal, Chemical composition, Particle size, Turbulence (atmospheric), Flow rates, Density, Electrical properties.

Dusts carried by flue gases are considered with respect to their composition, mode of formation, and chemical and physical properties. The materials from which flue dust is formed derive in part from unburned carbon and in part from inorganic mineral constituents of coal. They consist of inherent as well as adventitious ash, and their composition may include most of the elements in the periodic table. With regard to boiler corrosion and deposits, the constituents of most interest are those that influence the fusability of the ash and those that determine the proportion of ash escaping as volatile material. Dust-producing materials are released and formed by decomposition, reaction, volatilization, and mechanical pickup. Properties of flue dust determining its accumulation on heating surfaces are density, size, thermal motion, reactivity towards gaseous flue-gas constituents, and electrical characteristics. Concentrations of dust in boiler gases depend on local conditions of gas movement; thermal gradient; the particular relationship between particle size, velocity, and direction of the gas stream; and on factors connected with the release of dust from the fuel bed. Size and basicity of ash particles or aggregates in a coal-dust firing system diminishes from the combustion chamber toward the chimney; solids emitted by the chimney may consist of highly siliceous and refractory single particles. Smoke-density meters are quite efficient for measuring smokes and suspended particles in flue gases at stack levels, and a variety of devices are available for separating dusts from flue gases. In general, the most effective meteorological element in controlling the concentration of smoke is turbulence.
APTIC-24005

### LNG AT CONSUMER'S DOORSTEP.

For primary bibliographic entry see Field 02.
APTIC-24006

### VAPOUR INCINERATION.

For primary bibliographic entry see Field 02.
APTIC-24007

### PROJECTIONS OF POPULATION, VEHICLES, AND ACTIVITIES TO 1990 IN THE SACRAMENTO REGIONAL AREA.

In: The Air Pollution Threat. Technical Paper - 4, 4p., Oct. 1969. 4 refs. CFSTI: PB 191382
Personal Author Not Recorded.
Identifiers: *Sources, *Sacramento, *Trends, Socio-economic factors, California, Natural gas, Electric power production, Open burning, Vehicles.

The population of the Sacramento region is expected to increase by 75% from 822,000 in 1968 to an estimated 1,405,000; during the same period, the number of vehicles will double, according to estimates. Agricultural waste burning should decrease, although it may not disappear altogether. The types of new industry foreseen, e.g., assembly and fabrication plants and product distribution, are not expected to significantly affect the air quality situation. Natural gas will continue to be the main source of heating and power in the area.
APTIC-24012

### GENERAL INVENTORY OF AIR POLLUTION SOURCES AND EMISSIONS.

In: The Air Pollution Threat. Technical Paper - 1, 13p., Oct. 1969. 8 refs. CFSTI: PB 191382
Personal Author Not Recorded.
Identifiers: *Sacramento, *Emission inventories, California, Particulates, Natural gas, Industrial emission sources, Chemical processing, Food and feed operations, Incineration, Mineral processing, Primary metallurgical processing, Open burning, Solid waste disposal, Transportation, Aircraft, Diesel engines, Vehicles, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Sulfur dioxide.

The results of an inventory of pollution sources and emissions within the Sacramento region are tabulated for three categories: transportation (gasoline and diesel vehicles, railroads, and aircraft): agricultural waste burning; and stationary sources (agricultural product processing, petroleum handling to service vehicles, solvent use, solid

waste incineration, metal processing, mineral processing, chemical manufacturing, and combustion of fuels, mainly natural gas). The data were obtained by applying emission factors to information on types and amounts of materials processed, collected by several area agencies, and from existing surveys and reports. The inventory covers emissions of organic gases, carbon monoxide, nitrogen oxides, sulfur dioxide, and particulate matter.
APTIC-24013

### TOXICOLOGY OF SOME POLYMERS.

Space Biol. Med. (English translation from
Russian of: Kosmich. Biol. Med.), 3 (6):59-71,
Nov.-Dec. 1969. 37 refs. CFSTI: JPRS 49928
V. D. Yablochkin.
Identifiers: *Toxicity, *Polymers, Plastics, Ussr, Non-industrial emission sources, Formaldehydes, Hydrocarbons, Carbon dioxide, Carbon monoxide.

The qualitative composition is summarized of volatile toxic products emanating from the most important types of polymers used in construction. Among the various chemical groups of polymer construction materials are derivatives of polystyrene, polyethylene, polyvinyl chloride, polytetrafluoroethylene, polyamides, polyurethanes, polyesters, polysiloxanes, and also materials based on epoxy resins, synthetic and natural rubbers. Such substances as carbon monoxide, carbon dioxide, formaldehyde and hydrocarbons, are released from polymers having different properties and chemical structure. Data on the qualitative and quantitative characteristics of the products of gas release of polymer materials can be used in developing systems for purifying the atmosphere from toxic impurities and in selecting methods for upgrading polymer materials.
APTIC-24020

### RESEARCH CONCERNING VEHICLE EXHAUST AND LETTERS.

For primary bibliographic entry see Field 04.
APTIC-24031

### THE CONTROL OF NOXIOUS GASES AND FUMES DISCHARGED FROM INDUSTRIAL UNDERTAKINGS.

For primary bibliographic entry see Field 02.
APTIC-24033

### AIR POLLUTION PROBLEMS IN THE UNITED STATES.

World Health Organization, Copenhagen
(Denmark), Regional Office for Europe, Proc.
Conf. Public Health Aspects Air Pollution Europe,
Milan, Italy, 1957, p. 21-36. 11 refs. (Nov. 6-14.)
Philip Drinker.
Identifiers: *Industrial emission sources, Combustion products, Stack gases, Particulates, Smog, Fuels, Steam plants, Primary metallurgical processing, Stacks, Vehicles, Dispersion, Fluorine compounds, Nitrogen oxides, Sulfur dioxide, Oxone.

As in other countries, the demand for power in the U. S. is increasing steadily, at an estimated 3% annually. Bituminous coal is still the most used fuel, followed in order by oil and gas. Some of the coals used in the mid- and far-west have a sulfur content as high as 5%; thus some very large power stations emit sulfur dioxide in amounts comparable to those from smelters roasting sulfide ores. There is a general rule in the U. S. requiring power stations that burn coal in powdered form to clean their stack effluents of grit and ash before discharge. It is also common practice to make an extensive meteorological survey before building a tall chimney, to insure an adequate height for dispersion of smoke plumes. Pollution from ore smelters, by fluorides, and from vehicle exhausts, with emphasis on smog effects, is discussed. Attention has not been paid to date to nitrogen oxides in chimney gases; these concentrations increase with furnace temperatures, so that the better the plant is run the more oxides of nitorgen are given off. Although the technology for control of the more well known pollutants has made considerable progress, no practical method has yet been devised for control of nitrogen oxides.
APTIC-24039

### AIR QUALITY IN THE SACRAMENTO REGION IN 1990.

In: The Air Pollution Threat. Sacramento Regional
Area Planning Commission, Calif., Technical
Paper -5, 5p., Oct. 1969. CFSTI: PB 191382
W. L. Faith.
Identifiers: *Sources, *Sacramento, *Trends, California, Automotive emissions, Particulates, Industrial emission sources, Solid waste disposal, Vehicles, Automobiles.

The following assumptions are made in forming a 20-year projection for air quality in the Sacramento region: unchanged meteorological patterns and legal regulations; a population increase of 75%; an increase of combustible waste that keeps pace with the population increase; a doubling of the number of automobiles now in use; and similar percentages of industrial emissions as at present. It is estimated for 1990 that (1) motor vehicle emissions will be less than at present, despite the doubled number of autos because of more restrictive regulation and more effective controls; (2) particulate matter will probably be the most annoying pollutant; (3) the impact of industrial pollutants will depend largely on the nature of new industry; and (4) because of increasing public awareness and esthetic standards, the air quality projected for 1990 will be less acceptable than the expected differences in atmospheric concentration of specific pollutants would suggest.
APTIC-24067

### RESIDUAL CARBON PARTICLES YIELDED BY COMBUSTION OF ATOMIZED HEAVY-FUEL-OIL DROPLETS.

J. Inst. Fuel, vol. 43:295-300, Aug. 1970. 18 refs.
Takeshi Sakai, and Sachio Sugiyama.
Identifiers: *Coke, *Residual oils, *Particle size, *Combustion, Japan, Stack gases, Sprays, Droplets, Fuel oils, Furnaces, Mathematical analyses.

The distribution and the mean diameter of coke particles discharged with flue gas from the combustion of atomized heavy-fuel-oil droplets in a furnace was studied in relation to the distribution of the atomized heavy-fuel-oil droplets. An analytical method of determining the coefficients of the Gamma distribution function was developed that is easier and more exact than the semilog method. The critical coke generating droplet diameter was derived from the combustion history of a single heavy-fuel-oil droplet, and the relationship between the initial droplet diameter and the diameter of the discharged droplet was parabolic. This conclusion was applied to the combustion of a cloud of fuel-oil droplets. Thus, theoretical equations defining the mean diameters and distribution of the coke particles with respect to the distribution of initial droplets were obtained. Data from these equations were compared with data from work on a pilot furnace. The distribution and mean diameter of the coke particles discharged from the furnace were determined mainly by the distribution of the initial heavy-fuel-oil spray and the properties of the fuel oil, but not by the fuel:air ratio. (Author abstract modified)
APTIC-24076

### CONSERVING OUR ENVIRONMENT: WHAT CHEMICAL ENGINEERING CAN AND SHOULD DO.

For primary bibliographic entry see Field 02.
APTIC-24080

### IGNITION SYSTEM PERFORMANCE CAN AFFECT EXHAUST EMISSIONS.

For primary bibliographic entry see Field 02.
APTIC-24093

### PAINT AND AIR POLLUTION.

(Verf en luchtverontreiniging). Text in Dutch. T.
N. O. Nieuws, vol. 25:37-42, 1970.
T. Doorgeest.
Identifiers: *The netherlands, *Paint manufacturing, Europe, Paints.

Dutch paint manufacturers are well aware of the fact that application of the products of the paint industry does contribute to air pollution. This awareness has resulted in a joint investigation by paint manufacturers and TNO into the contribution of paint producers and paint users to air pollution in the Netherlands. From information received mainly from members and co-members of the Vereniging Voor Verf-Research (Dutch Society for Paint Research) it was calculated that paint producers and paint users are together responsible for approximately 0.1% of the harmfulness of air pollution in the Netherlands. Moreover the conclusion was drawn that the percentage mentioned will decrease slowly in the coming years. (Author abstract modified)
APTIC-24096

### AEROSOL MODELING OF HYPOTHETICAL LMFBR ACCIDENTS.

North American Rockwell Corp., Canoga Park,
Calif., Atomics International Div., Contract AT
(04-3)-701, Rept. AI-AEC-12977, 86p., Aug. 31,
1970. 46 refs.
R. L. Koontz, L. Baurmash, M.A. Greenfield, C.
T. Nelson, and D. F. Hausknecht.
Identifiers: *Aerosols, *Nuclear explosions, *Reactors (nuclear), *Mathematical modeling, *Radioactive radiation, Transport, Turbulence (atmospheric), Sodium compounds, Particle growth.

A description of an aerosol model program which is directed toward the characterization of the aerosols produced during sodium fires and other postulated Liquid Metal Fast Breeder Reactor (LMFBR) accidents, particularly the explosive disassembly regime, is presented. One of the key objectives of the program has been to develop analytical methods and tools for predicting aerosol transport following various accidents. As the program has progressed through various experimental and anlaytical stages, the analytical methods which evolved have been improved with respect to engineering, applicability, and accuracy, and also, level of confidence. The aerosol program has progressed to the point where the present theoretical aerosol model (HAA-3) has been extended to compute high mass concentration cases. Since these calculations have been tested with reasonable success against experiments in a 30-ft-tall test chamber (the approximate height of primary vaults for a typical LMFBR), HAA-3 can be confidently used in evaluations of potential releases from similar sized structures. Description of the HAA-3 aerosol model is consistent with existing experimental data and can be used as design input in establishing the capability of containment-related design features of LMFBR's. A detailed justification of the model and the application of various model assumptions and parameters to accident conditions is described. A description is presented of additional aerosol behavior characteristics suggested by experimental data or analytical considerations, which are not completely resolved. The potential effects of these characteristics are discussed in detail. HAA-3 can be applied with confidence to the site analysis of the current designs of LMFBR's since all agglomeration takes place in the inner containment system and only settling occurs in the outer containment before leakage to the atmosphere. Under these conditions HAA-3 provides a substantially conservative prediction of particulate release to the atmosphere. confidence in the model for predicting the radioactive aerosol leakage source term for siting analysis

is obtained from a detailed evaluation of uncertainties in aerosol parameters as applied to DBA conditions, and from the effect of these uncertainties on site safety analysis. Further substantiation of some of the parameters used in HAA-3 is recommended. (Author summary modified)
APTIC-24108

### ATMOSPHERIC POLLUTION.

Ind. Eng. Chem., 44 (1):113A-114A, 116A, Jan. 1952.
Louis C. McCabe.
Identifiers: *Los angeles, *Lead compounds, Stack gases, Metal fabricating and finishing, Bag filters, Oxides.

The section of lead reclamation is reviewed from the United States Bureau of Mines Information Circular entitled 'Control of Metallurgical and Mineral Dusts and Fumes in Los Angeles County, Calif.' Although Los Angeles is not a primary lead smelting center, it nevertheless has an appreciable amount of secondary smelting operations in reclaiming lead scrap, particularly battery plates. Some 175 copper-base alloy foundries normally are in production in the area and many of these melt leaded copper alloys. The concentration of lead in high-lead copper alloy fumes, from a typical plant, following dilution of the fumes with 2.6 volumes of air from outside the furnace amounted to 0.026 grain per cu ft, or about 394 times the threshold limit. Although lead in furnace fumes is usually reported as elemental lead, there can be little doubt that it exists as some form of lead oxide. Settling chambers and water curtains or spray-type collectors were formerly used in lead reclaiming plants in the Los Angeles area with unsatisfactory results. The baghouse has long been considered the most acceptable device for collecting lead fumes, and many large installations are in operation at primary lead reduction works. The metallurgical practices of the Los Angeles area and stack effluents are also mentioned.
APTIC-24115

### ATMOSPHERIC POLLUTION.

For primary bibliographic entry see Field 02.
APTIC-24116

### TOXICOLOGIC ASPECTS OF FLAMMABILITY AND COMBUSTION OF POLYMERIC MATERIALS.

For primary bibliographic entry see Field 07.
APTIC-24153

### SPECIAL EDITION ON MOTOR VEHICLE EXHAUST - FROM MANUFACTURER'S VIEWPOINT.

(Jidosha haiki tokushu - Meka toshiteno tachiba). Text in Japanese. Sangyo Kogai (Ind. Public Nuisance), 6 (9): 553-562, Sept. 25, 1970. 3 refs.
Takashi Kobayakawa.
Identifiers: *Engine exhausts, *Automobiles, *Lead compounds, Air pollution episodes, Emission standards, Japan, Automotive emissions, Smog, Control equipment, Fuel additives, Hydrocarbons, Carbon monoxide, Sulfur dioxide.

Both a lead poisoning episode and a photochemical smog episode that occurred in Tokyo during the summer of 1970 are attributed solely to auto exhaust gas emissions. These accidents are discussed in the context of the problems facing automobile manufacturers in their attempts to control exhaust emissions. The technology exists for removing lead from vehicle emissions, but, reported in the United States the control devices have a number of disadvantages. A considerable quantity of CO and HC emission in return is evident, along with a slow-down of horsepower, troubles with engine unit, and an increase in fuel consumption. Apart from these mechanical aspects, the tolerance limit of lead in the human body has not yet been definitely determined. This factor also delays the development of prototype devices capable of meeting the ambient standard to be issued in the near future. The unforeseen photochemical smog can be attributed to sulfur mist: it was not photochemical smog in the strict sense because there were recognized differences between and Los Angeles smog. The existing Japanese carbon monoxide emission standard from motor vehicles is more strict than that of the United States, since the permissible limit varies according to maximum weight and types of vehicles.
APTIC-24156

## 2. CONTROL METHODS

### PROJECT FOR SCALING NATURAL DRAFT SYSTEMS IN CONNECTION WITH THE DISPERSION OF AIR POLLUTING SUBSTANCES.

(Progetto dei sistemi a tiraggio naturale per la dispersione degli inquinanti atmosferici.) Text in Italian. Ingegnere (Milan), p. 1011-1014, Nov. 1968. 15 refs.
Antonio Peloso.
Identifiers: *Stacks, *Design criteria, Italy, Smokes, Pressure, Temperature.

Chimney and smoke stacks are scaled today according to methods suggested by various authors, such as Ferraiolo, Chalker, Steinbock, and others. All their methods are based upon empirical procedures. In fact, they assume that the efflux speed of warm smokes ranges between 3.5 and 10 meters per sec. They also assume that the available draft is enough to balance the loss of smoke pressure during its efflux through the chimney. These methods, besides requiring many calculations, are questionable both economically and technically. A new procedure for scaling chimneys is based on the assumption of constant temperature of the external air and internal smoke. The latter temperature must be taken at the top of the chimney. Smoke and external air are assumed to have the same density, in normal conditions. The friction is also considered independently of the Reynolds number. These basic suppositions allow a precise calculation of the smoke speed and its draft, permitting the determination of the proper and adequate diameter of the chimney and the geometric height of the system.
APTIC-18277

### ESTIMATION OF THE AMOUNT OF FILTER DEMAND.

(Filter no Jyuyoryo Suitei no Ichi Hoho.) Text in Japanese. Kuki Seijo (Clean Air -J. Japan. Air Cleaning Assoc., Tokyo), 6 (5):75, Nov. 1968.
Soichi Nozaki.
Identifiers: *Japan, *Filters, Commercial firms.

A method of estimating the total surface area of filter needed by a manufacturer for one year is presented. The total number of units requiring filters estimated to be sold nationally during the year is multiplied by the amount of air in cu m per minute and divided by the velocity of the air through the filter (in m per sec) times 60. The estimated number of filter panels of a specific length can be obtained by multiplying the total surface area (from the preceding formula) by the filter efficiency, percent of the national market to be captured, and the estimated annual increase in the percent of the market for that size filter, and dividing by the surface area of each panel.
APTIC-18278

### WET SCRUBBERS FOR CUPOLA FURNACES.

(Nassentstauber fuer Kupoloefen.) Text in German. Giesserei (Duesseldorf), 56 (10): 281-284, March 1969.
Albrecht-M. Karkowski.
Identifiers: *Dusts, *Cupolas, *Spray towers, Germany, Pollutants, Particulates, Sources, Furnaces, Scrubbers, Sulfur oxides, Primary metallurgical processing.

Current regulations of the North Rhine Westphalia province establish maximum dust discharges of 1.5. kg dust per ton of melt for new cupola furnaces in iron foundries. A description is presented of a wet scrubber which has been in operation for more than two years, and which has reduced dust emission to less than 0.5 kg/ton of melt. The high efficiency is obtained by the use of a 2-stage arrangement in which the coarse particles are removed in the first stage, and the fine particles in the second stage. A special zigzag design ensures a high collision rate between the dust particles and the water. Sulfur oxides are also removable through the addition of soda to the water. Trouble-free operation is attributed to the fact that the only movable parts are in the water pump and the ventilator.
APTIC-18285

### CONCEPTS OF FABRIC FILTRATION FOR AIR POLLUTION CONTROL.

Filtration Separation (Purley), 6 (3):254-257, May/June 1969. (Presented to the Midwest Chapter of the Filtration Society, Chicago, Ill., Nov. 21, 1968.)
Kenneth E. Jensen.
Identifiers: *Filter fabrics, Odors, Dusts, Control equipment, Collectors, Settling chambers, Filters, Bag filters, Scrubbers, By-product recovery, Gases.

Brief reviews of settling chambers, mechanical collectors, wet collectors or scrubbers, precipitators, and ultrasonic cleaners were given. The advantages of filtration through fabric media were discussed including inherent efficiencies down to the sub-micron range and independence of supplementary devices and materials, such as water and electrical charges. Conditions listed that would preclude or complicate cloth filtration included wet gases, gaseous emissions, and odors. Cleaning actions for fabric filters were discussed in reference to commonly used types, such as woven cotton sateen, synthetics, Nomex, Teflon, and wool. A checklist was provided to cover information required to select a filter. Dry cloth collection is discussed for use extensively as the terminal receiver in pneumatic conveying systems and venting of bins filled by pneumatic means.
APTIC-18287

### EXPERIENCES WITH DUST CONTROL IN THE MOLDING-SAND DEPARTMENT OF A STEEL FOUNDRY.

(Doswiadczenia uzyskane przy odpylaniu oddzialu przerobki mas formierskich w odelwni staliwa.) Text in Polish. Przeglad Odlewnictwa, 19 (3):113-118, March 1969. 4 refs.
Judit Karpati, and Gyorgy Mathe.
Identifiers: *Dusts, *Control equipment, *Primary metallurgical processes, Europe, Sources, Industrial emission sources, Primary metallurgical processing, Particulate sampling, Collectors, Wet cyclones.

In the course of reorganizing the operations of the molding-sand department of a steel castings plant to achieve greater output without heavy investment, additional equipment was installed for the purpose of dust extraction and removal. The working areas which were the most important generators of dust were readily identified by visual inspection, and the equipment, consisting of dust extractors and intraplant sand storage bins, so placed that the sand had to pass through them before being sent to the molding department. It was found that it is necessary to provide covers for both extractors and storage bins, since otherwise the dust will escape into the ambient air. Cyclones proved to be suitable for dust extraction, being easy to construct and maintain; their only drawback is high water consumption. The cleansed air is discharged outdoors, and makeup air is provided. In the wintertime, the makeup air is heated before being introduced into the system. As a result of installing the equipment, the number of dust grains per cu cm decreased from 318 to 231 at one location and from 1207 to 578 in the dustiest area.

APTIC-18288

### AIR POLLUTION FROM CUPOLAS.

For primary bibliographic entry see Field 01.
APTIC-18293

### EXHAUST GASES FROM GASOLINE POWERED VEHICLES.

For primary bibliographic entry see Field 01.
APTIC-18294

### DIMENSIONING OF FLUES AND RUNNING CONDITIONS IN MEDIUM-SIZED HEATING PLANTS.

For primary bibliographic entry see Field 01.
APTIC-18296

### AIR POLLUTION AND THE MANUFACTURE OF INORGANIC CHEMICALS.

(Luftfororening vid framstallning av oorganiska baskemikalier.) Text in Swedish. Statens Naturvardsverk, Stockholm, Publikationer No. 4, 66p., 10 refs.
L. Lindau.
Identifiers: *Chemical processing, *Acids, *Control methods, *Costs, *Sweden, Industrial areas, Contact processing, Absorption, By-product recovery, Sulfur oxides control, Penelec (contact process), Hydrochloric acid, Nitric acid, Phosphoric acid, Sulfuric acid, Ammonia, Chlorine, Fluorine, Sodium hydroxide, Sulfur oxides.

The investigation deals with air pollution problems in connection with the manufacture of basic inorganic chemicals such as sulphuric acid, hydrochloric acid, phosphoric acid, ammonia, nitric acid, chlorine and sodium hydroxide. The report contains a survey of present conditions, an analysis of various technical methods to reduce the emissions, and a discussion of the economic consequences of these methods. The purpose of the survey is to supply information to the Swedish authorities dealing with air pollution control. The rates of emission from the chemical plants are described as kg/ton product. The costs of air pollution abatement vary. In certain cases, e.g., the recovery of sulphur in connection with the production of ammonia, the necessary investments can be written off. In other cases, e.g., introduction of the double-contact process for the manufacture of sulphuric acid, the increasing yield can only partially motivate the investments required. There are also cases when the costs entirely belong to the air pollution account. A comparison between Swedish and foreign plants indicates that emissions are of the same magnitude. Essential improvements are possible to obtain in new plants and the latest Swedish production units have applied this to a great extent.
APTIC-18305

### IMPROVEMENTS IN THE RELATING TO THE WASHING OF FLUE GASES FROM COMBUSTION FURNACES AND THE LIKE.

(Assignee Not Given.) Brit. Pat. 360, 574. Nov. 12, 1931. (Appl. Sept. 20, 1930, 15 claims).
Henry James Hodsman, and Alan Taylor.
Identifiers: *Catalytic oxidation, *Alkaline additives, Great britain, Stack gases, Furnaces, Scrubbers, Design criteria, Ammonia, Iron compounds, Sulfates, Sulfites, Ph, Temperature.

A method for removing sulfur oxides from flue gases is described. Flue gases containing sulfur oxides and free oxygen are continously passed through a chamber containing free ammonia and ammonium sulfate in soltution. The gases and solution are contacted con-currently so that the sulfur oxides are neutralized. Ammonium sulfite is formed and its concentration is kept low by partial or complete oxidation to ammonium sulfate by the oxygen contained in the gases. The aqueous ammonia solution, the quantity of sulfur oxides, and their rates of passage through the chamber are correlated so that the sulfur oxides are completely removed and the solution passing out of the chamber is slightly acid whereby the escape of ammonia with the treated gases is avoided. If the solution passing out of the chamber contains unoxidized ammonium sulfite, it is further oxidized in a separate vessel. The solution should contain a ferrous compound to catalyze the oxidation of ammonium sulfite. After the solution has been completely oxidized and the ammonium sulfate removed, it is made alkaline with free ammonia and again contacted with flue gases.
APTIC-22170

### PROCESS FOR THE RECOVERY OF ELEMENTARY SULPHUR FROM A HYDROGEN SULPHIDE-CONTAINING GAS.

(Shell International Res. Co., The Hague) Brit. Pat. 1,138,437. 7p., Jan. 1, 1969. (Appl. May 26, 1967, 15 claims).
Mohammed Akbar.
Identifiers: *Catalytic oxidation, *Hydrogen sulfide, Europe, By-product recovery, Sulfur dioxide, Sulfur compounds, Condensation, Cooling, Steam, Temperature.

A method for producing elemental sulfur from hydrogen sulfide-containing gases is described. The H2S-containing feed gas is burned with air or another oxygen-containing gas to produce a hot gas containing elemental sulfur, sulfur dioxide, and H2S. The hot gas is then cooled in a waste heat boiler to a low temperature so that the elemental sulfur is condensed and removed. The cooled gas is then heated by high pressure steam and mixed with a second H2S-containing gas. This gas mixture is contacted with a catalyst to form a gaseous product containing elemental sulfur which is condensed and removed. The overall molar ratio of H2S in the feed gas, as well as in the second H2S-containing gas to the amount of oxygen is from 0.45 to 0.60.
APTIC-22171

### PROCESS FOR THE RECOVERY OF SULPHUR DIOIXDE FROM GASES CONTAINING SAME.

(Metallgesellschaft A. G., Frankfurt am Main (West Germany)) Brit. Pat. 485,955. 4p., May 27, 1938. 1 ref. (Appl. May 6, 1937, 5 claims).
Personal Author Not Recorded.
Identifiers: *Absorption (general), Germany, Alkaline additives, Sulfuric acid, Carbonates, Hydroxides, Sodium compounds, Amines, Cooling.

A process for recovering sulfur dioxide from SO2-containing gases is described. Concentrated SO2 can be recovered by contacting the gas with a mixture of organic bases, such as aromatic amines, and water. Absorbed SO2 is expelled by heating the absorption liquid. The organic-base sulfates formed in the liquid are decomposed, by the addition of sodium hydroxide or a sodium salt of a weak acid, to the free organic base and sodium sulfate which passes into solution in the aqueous portion of the liquid. When sodium compounds are used, some the absorption liquid must be withdrawn and replaced by fresh water due to the accumulation of sodium sulfate. The rejected solution also contains various amounts of the bases whose loss is uneconomical for the process. This can be avoided if the sodium sulfate is removed from the solution in the form of Glauber salt, which is accomplished by cooling the solution to 2 C. The solution, thus freed of the salt, is returned to the absorption process. It is recommended that the aqueous phase be treated when all the sulfuric acid present is combined with the sodium. The salt solution is used to dissolve the sodium compounds which are added to decompose the organic-base sulfates in the absorption liquid.
APTIC-22172

### IMPROVEMENTS IN OR RELATING TO THE COLLECTION OF SULPHUR FROM GASES.

(Imperial Chemical Industries Ltd., London (England)) Brit. Pat. 355,832. 5p., Aug. 31, 1931. (Appl. May 31, 8 claims).
Arthur Maurice Clark.
Identifiers: *Sulfur compounds, *Particle growth, Great britain, Fumes, Mists, By-product recovery, So2 removal (combustion products), Condensation, Cooling, Temperature.

A process for separating elemental sulfur from gases which contain it in gaseous or finely divided liquid or solid state is described. This method is designed to collect sulfur from the hot gaseous reaction products of the reduction of sulfur dioxide by carbon. When such dilute sulfur vapors are cooled from the elevated temperature at which they are formed, the sulfur condenses to a mist or a fume that is difficult to separate from the gas. If the mist or fume is cooled to a moderately elevated temperature ranging from the condensation temperature to 100 C, the sulfur particles coagulate and are brought to a coarser state of division. The mist or fumes should be slowly cooled in a series of vessels maintained at a uniform temperature to provide the necessary time for growth of the sulfur particles.
APTIC-22173

### IMPROVEMENTS IN OR RELATING TO THE WET PURIFICATION OF GASES.

(Imperial Chemical Industries Ltd., London (England)) Brit. Pat. 433,373. 7p., Aug. 6, 1935. (Appl. Feb. 5, 1934, 6 claims).
Gordon Nonhebel, and John Lindon Pearson.
Identifiers: *Alkaline additives, *Ph, Great britain, Stack gases, Scrubbers, Design criteria, Hydrochloric acid, Carbonates, Sulfates, Sulfites.

Removal of sulfur oxides and other strongly acidic gases, such as hydrochloric acid, from flue gases is described. The gases are passed through a scrubber in contact with water containing calcium bicarbonate and some calcium carbonate in suspension. Liquor leaving the scrubber is replenished by adding chalk or lime before recirculation. The lime or chalk is added in an amount approximately equal to the sulfur oxides or other strongly acid gases absorbed from the flue gas. Addition is regulated by determining the pH of the scrubber exit liquor, continuously or at frequent intervals, and adding sufficient lime or chalk to keep the pH within the range 6.0 to 6.4. The lime or chalk may be added continuously in the form of a slurry. A control system for regulating the amount of lime or chalk is also included. It consists of a continuous pH recorder to measure the pH of the exit liquor, an electric motor to operate a valve in the lime or chalk slurry addition pipeline, and a relay mechanism. The relay mechanism is actuated by the pH recorder for operating the motor to vary the opening of the valve in accordance with pH of the scrubber exit liquor.
APTIC-22174

### CANADIANS PIONEER NEW FLY ASH PROCESSING SYSTEM.

Minerals Process., 10 (3):16-19, March 1969.
Joseph F. Boux.
Identifiers: *Fly ash, *By-product recovery, Canada, Coal, Electric power production.

Reclamation of huge quantities of fly as produced by power generating stations can be of great importance in the economics of these coal-fired plants. By total utilization of the fly ash, the plant described produces a number of commercial products: a fine pozzolanic fraction useful as a cementitious material in concrete; an iron concentrate which could be pelletized for blast furnace feed; carbon which could be used as fines or pelletized for fuel; and a large volume of beneficiated fines which would be processed into lightweight aggregates. Plant design is based on upgrading the fly ash by separating its various components which are uniform in specification. All fly ash,

both from mechanical and electrostic precipitators, is separated into two main fractions: a fine fraction with 90% passing mesh and a coarse fraction of plus 325 mesh. Since the coarse material retains most of the iron values, it is passed through a magnetic separator that produces the iron fine concentrate and a coarse sinter fuel. The fine fraction can also be sintered if necessary to meet product requirements. Provision has also been made to screen the coarse fraction when there is an excess of carbon particles. Products of these processes are much more uniform than raw fly ash and each can be more readily converted into commercial products.
APTIC-22175

### OPTIMIZATION OF THE OPERATIONAL VARIABLES OF ENGINES WITH CONTROLLED IGNITION FOR AUTOMOBILES WITH THE GOAL OF REDUCING THE EMISSION OF POLLUTANTS.

(Sull'ottimizazione delle variabili di funzionamento dei motori ad accensione comandata per autoveicoli ai fini della riduzione delle emissioni di inguinanti). Text in Italian. A. T. A., Assoc. Tec. Automobile (Turin), no. 6:307-318, June 1968. 32 refs.
Giuseppe Gabola, and Massimo Feola.
Identifiers: *Spark ignition engines, *Air-fuel ratio, *Spark timing, Italy, Engine design modification, Hydrocarbons, Carbon monoxide, Nitrogen oxides.

A review of published data on the problem of emission of air pollutants by internal combustion engines is presented in which the means for limiting the emission of noxious substances are classified as A) conversion devices built into the exhaust system; B) modifications of the combustion chamber; C) variants of fuel feed devices; and D) variants ignition timing devices. The various existing means falling in these classes are discussed. Those falling into classes C) and D) and, more specifically, to means of controlling the air-fuel ratio and the spark advancement angle timing are analyzed. Existing mechanical electronic automatic control systems for air-fuel ratio are satisfactory whereas, of those for timing, only the electronic one is sufficiently accurate to maintain the desired operating conditions. The effects of air-fuel ratio and timing on the emission of carbon monoxide, unburned hydrocarbons and oxides of nitrogen are reviewed in detail. The procedure for finding the set of pairs of values of air-fuel ratio and spark advance angle which give the greatest reduction in toxic emissions with the least sacrifice of engine performance is presented in detail for the case of optimization under the condition of a minimal emission of unburned hydrocarbons. The realization of the optimal set of value pairs presupposes the availability of sufficiently compliant automatic control systems for air-fuel ratio and timing. Most advantageous would be electronic control systems with electronic computers which would provide quasicontinuous and quasiinstantaneous adjustments of these two parameters on the basis of information regarding the current state of the engine.
APTIC-22179

### PRESENT STATUS OF DESULFURIZATION TECHNIQUE (1).

(Datsuryu gizutsu no genkyo (1)). Text in Japanese. Ryusan (J. Sulphuric Acid Assoc. Japan), 20 (11):247-254, Nov. 1967.
T. Takagi.
Identifiers: *Sulfur oxides control, Japan, Combustion gases, Catalytic oxidation, Fuel oil preparation, Absorption (general), Alkaline additives, Alkalized alumina, Manganese dioxide (japanese), Dispersion, Catalysis.

Three methods for the elimination of sulfur in industrial combustion are desulfurization of the crude oil, desulfurization of the exhaust gas, and atmospheric dispersion of the exhaust gas. The last of these is used extensively. The second, desulfurization of the exhaust gas, has been the subject of much study. There are currently five principal processes in use for exhaust gas desulfurization. The manganese oxide method uses powdered MnO (particle dia 10-100 micron) as an adsorbent; the reaction between the sulfur dioxide and the MnO yields $MnSO_4$. The activated carbon method uses activated carbon as an adsorbent. The vanadium 205 contact method catalytically oxidizes the $SO_2$ in the exhaust gas to $SO_3$ at 450 C (Berneck Method, Kiyoura Method). The alkalized alumina method uses 64% $Al_2O_3$ and 21% $Na_2O$ to convert the $SO_2$ into $Na_2SO_4$. The lime method uses powdered lime or dolomite directly within the hearth. Any of these methods can obtain desulfurization efficiencies greater than 90%. The Institute of Industrial Technology has selected the first two of these methods for study of their applicability to large desulfurization systems, 6000 N cu m/hr for the activated carbon method and 150,000 N cu m/hr for the Mn O method.
APTIC-22180

### METHOD OF REGENERATING ADSORBING COKES CHARGED WITH SULFURIC ACID.

(Procede de regeneration de cokes adsorbants charges d'acide sulfurique). Text in French. (Bergwerksverband G.m.b.H., Essen, W. Germany) Belg. Pat. 707,739. 9p., June 10, 1968. (Appl. Dec. 8, 1967. 4 claims).
Personal Author Not Recorded.
Identifiers: *Coke, *Adsorption, *Regeneration, Germany, Adsorption (general), Sulfuric acid, Hydroxides, Potassium compounds, Sodium hydroxide, Gases, Temperature.

A method is described for the regeneration of adsorbing cokes charged with sulfuric acid after having served to fix sulfur dioxide obtained from gas containing $SO_2$ in the presence of oxygen and water vapor. The adsorbing coke charged with $H_2SO_4$ is first washed in the known manner by means of hot water or of aqueous solutions. Between 1 and 5% (by weight) sodium or potassium hydroxide is added to the wet coke and the coke is heated in an inert atmosphere at a nominal 600-1000 C (400 C minimum) for 1/2 - 4 hours. The thermal treatment includes simultaneous rinsing by means of an inert gas.
APTIC-22182

### METHOD OF REMOVING SULFUR OXIDES FROM GAS WHICH CONTAINS THEM.

(Procede pour l'elimination d'oxydes de soufre de gas en contenant). Text in French. (Bergwerksverband G.m.b.h., Essen, W. Germany) Belg. Pat. 698.069. 9p., Nov. 6, 1967. (Appl. May 5, 1967. 5 claims).
Personal Author Not Recorded.
Identifiers: *Combsution gases, *Adsorption (general), Carbon black, Charcoal, Germany, Combustion gases, Coke, Ammonia, Oxygen, Water.

A method is described for the removal of sulfur oxides as well as of oxygen and water vapor contained in combustion gases, by means of carbonaceous adsorbents. Ammonia is added to the combustion gases before their entry into the adsorbing agent or directly into the layer of adsorbent. The adsorption of sulfur oxides is accomplished at a temperature of the adsorbing mass of less than 200 C, preferably between 80 and 160 C. A mole ratio between the ammonia and the sulfur oxides between 1:1 and 1:4 is maintained. Metallurgical coke or activated charcoal are used as the carbonaceous adsorbing agents.
APTIC-22183

### METHOD OF REMOVING SULFUR OXIDES FROM GAS MIXTURES.

(Procede d'elimination des oxydes de soufredes me langes gazeux). Text in French. (Firma Carl Still, Recklinghausen (W. Germany)) Belg. Pat. 692,466. 13p., March 15, 1967. (Appl. Feb. 23, 1966. 10 claims).
Josef Schmidt, Heinrich Weber, Wilhelm Schmitz, and Rudolf Brosch.
Identifiers: *Absorption (general), Germany, Stack gases, Centrifugal separators, Hydroxides, Aluminum compounds, Calcium compounds, Iron compounds, Magnesium compounds, Manganese compounds, Potassium compounds, Sodium hydroxide, Oxides, Sulfites.

A method is presented of removing sulfur oxides by absorption, particularly, sulfur dioxide from a gas or a gas mixture, particularly from industrial waste gases such as flue gases. The gases are treated with metal hydroxides, which, under these conditions are transformed mostly into sulfites. The hydroxides of iron, aluminum and manganese of alkaline metals such as sodium and potassium, of alkaline earth metals such as calcium and magnesium, or mixtures of these hydroxides are used, in addition to residues containing oxides of alkaline-earth metals, stemming from the combustion of solid fuels or from the treatment of minerals, in particular the ashes of lignite after transformation of the oxides of alkaline-earth metals into hydroxides of these metals. The ashes are mixed with up to 50% hydroxides of alkaline earth metals. The ashes or their mixtures with hydroxides of alkali-earth metals are in fixed beds of a grain size between 0.5 and 10 mm, preferably between 1 and 5 mm. The treatment is carried out in a turbulent bed. One part of the metal hydroxides is re-cycled and re-used; the removal of the metal hydroxide is performed by cyclones. The gases containing the S oxides are treated at temperatures between 120 and 300 C, preferably between 130 and 170 C. A flue gas having a total content of sulfur oxides, evaluated in the form of $SO_2$, between 1 and 10 grams/cu m (volume at normal temperature and pressure) and, preferably between 1 and 5 grams/cu m is used.
APTIC-22185

### METHOD OF REFORMING PETROLEUM HYDROCARBONS CATALYTICALLY AT AN ELEVATED PRESSURE BY THE USE OF STEAM.

(Procede de reformage catalytique et sous pression elevee des hydrocarbures petroliers par la vapeur). Text in French. (Entreprise miniere et chimique, Toulouse (France), Office National Industriel de l'Azote) Belg. Pat. 709 515. 11p., Feb 29, 1968. (Appl. Jan. 18, 1967, 11 claims).
Andre Roche.
Identifiers: *Petroleum refining, *Steam, *Catalysts, France, Natural gas, Aliphatic hydrocarbons, Cobalt compounds, Magnesium compounds, Manganese compounds, Nickel compounds, Titanium compounds, Aluminum oxides, Carbon dioxide, Carbon monoxide, Silicon dioxide.

Improvements are presented in catalytically reforming hydrocarbons which is carried out in catalyst-bearing tubes. The transformation of the suitably pre-heated reaction mixture takes place inside of two catalytic masses of different compositions and specific properties which are arranged 'incascade' and maintained at different temperatures. The catalyst of the first stage is highly selective and is formed of 1.2 to 3.0% nickel and/or cobalt (expressed as oxides) and a ceramic base of alpha-alumina with more than 99.5% $Al_2O_3$ having a specific surface area of 0.06 to 0.3 sq m/gram and containing 1.5 to 3.0% (expressed as oxides) of an alkaline-metal and/or alkaline-earth metal carbonate or hydroxide and possibly magnesia, together with a binder or plasticizer. In making a catalyst of the first stage, alumina is ground to paste possibly with magnesia and binder or plasticizer additions formed by extrusion and dried, or else it is mixed dry with these ingredients, granulated and pressed into pellets. In either case, it is finally calcined at 1100 to 1400 C. The resulting base material may then be impregnated in a concentrated solution of Ni salt capable of thermal dissociation and in an aqueous solution of an alkaline-metal and/or alkaline-earth metal carbonate or hydroxide. Alternatively either

one or both of these two kinds of additions can be made in the pasty or the dry state of the alumina. The catalyst of the second stage is of the classical type and is specific for endothermic reactions of conversion of natural gas by steam and/or CO2 or hydrogen and CO.
APTIC-22186

### CATALYTIC REDUCTION OF SULPHUR DIOXIDE TO HYDROGEN SULPHIDE.

(Shell International Res. Co., The Hague) Brit. Pat. 1,116,129. 7p., June 6, 1968. 1 ref. (Appl. March 2, 1967, 15 claims).
Henricus Johannes Antonius Van Helden.
Identifiers: *So2 removal (combustion products), *Hydrogen sulfide, *Reduction, Stack gases, Methanes, Vanadium compounds, Pressure, Temperature.

A process for catalytically reducing sulfur dioxide to hydrogen sulfide is described. In other processes the catalyst requires high temperatures for the reduction and it is conducted at low space velocities, whereas this process may be conducted at a low temperature and with a high space velocity. Sulfur dioxide and a reducing gas, such as methane, are contacted with a catalyst. The catalyst consists of vanadium pentoxide or trioxide with a carrier of gamma-alumina; the vanadium content is from 1 to 20%. The ratio between the partial pressures of the reducing gas and the SO2 is less than 20. The reduction reaction occurs at a space velocity between 100 and 2000 volumes of gaseous mixture/volume of catalyst/hr, and at a temperature from 300-600 C. The SO2-containing gas may be divided into two streams before the reduction. The second stream, consisting of 2/3 of the gas, is combined with the reducing gas and contacted with the catalyst. After the reduction it is combined with the first stream to form a feed gas for the production of elemental sulfur.
APTIC-22188

### RECOVERY OF SULFUR FROM SULFUR DIOXIDE IN WASTE GASES.

Ind. Eng. Chem., 36(4):329-332, April 1944. 10 refs. (Presented at the American Chemical Society, 106th National Meeting, Division of Petroleum Chemistry, Pittsburgh, Pa., 1944.)
T. F. Doumani, R. F. Deery, and W. E. Bradley.
Identifiers: *So2 removal (combustion products), *Catalytic activity, By-product recovery, Iron compounds, Aluminum oxides, Hydrogen sulfide, Thermodynamics, Temperature.

Elementary sulfur is recovered from gases containing sulfur dioxide by a two-step catalytic process operating at atmospheric pressure. Wet gases containing relatively low percentages of sulfur dioxide can be treated. In the first step the sulfur-dioxide-containing gas is mixed with hydrogen and passed through a catalyst bed at temperatures above 300 C. A gel-type catalyst comprising about 25% iron sulfide and 75% alumina is effective. In the second step complete conversion to elemental sulfur is accomplished by passing the mixture of hydrogen sulfide and sulfur dioxide from step one over activated alumina at temperatures from 100 to 200 C. The sulfur tends to deposit in the catalyst bed and eventually deactivates the catalyst, but the reactivation of the latter is readily accomplished by raising the temperature of the catalyst bed above 500 C. Chemical and thermodynamic equations for the reduction of sulfur dioxide with hydrogen and hydrogen sulfide are presented tabularly, and a diagram of the apparatus for the reduction is included. (Author abstract modified)
APTIC-22197

### PROCESS OF SEPARATING SULPHUR DIOXIDE FROM GASEOUS MIXTURES.

(Assignee Not Given.) Can. Pat. 317,948. 9p., Dec. 15, 1931. (Appl. date not given, 10 claims).
Maitland C. Boswell.
Identifiers: *Scrubbers, *Absorption (general), *Quinolines, Canada, Inorganic acids, Sulfites, Heat transfer, Water.

A method of separating sulfur dioxide from gaseous mixtures in which it is present in small proportions is described. The high vapor pressure of SO2 and the slow rate of absorption by liquids renders separation by absorption inefficient. At atmospheric temperatures and pressures, quinoline containing water is capable of rapidly and completely removing SO2 from gaseous mixtures. A chemical reaction occurs between the quinoline-water complex and SO2 to form quinoline sulfite. The SO2-containing gas, freed from dust and sulfur trioxide and cooled to below 30 C, is passed through scrubbers containing the reagent. The reagent may be dry or mixed with water and dissolved in glycerol or petroleum. The exit gases, containing a small amount of the base vapor, are passed through a tower containing a dilute inorganic acid which removes the base. This acid solution is treated with lime to recover the organic base. Scrubbing liquid is passed to a heater where it is raised to 70-110 C to expel the SO2. The SO2 passes to a cooler and then to a compressor for collection as liquid SO2. The quinoline-water complex flows through a cooler and is then recirculated to the scrubber to remove additional SO2 from gases.
APTIC-22202

### RECOVERY OF SO2 FROM DIGESTER BLOW-OFF GASES.

(Assignee Not Given.) Can. Pat. 410,409. 22p., July 21, 1941. (Appl. date not given, 7 claims).
Horace A. DuBois.
Identifiers: *Digesters, *Absorption (general), Canada, Packed towers, Design criteria, Condensation, Steam.

A method of recovering the sulfur dioxide intermittently discharged by the digesters of sulfite pulp plants is described. Water vapor contained in the blow pit ventilation gas is first condensed in a packed tower. The condensing water is supplied at such a rate that the waste water formed is at a temperature slightly under its boiling point. In this way all of the steam is condensed from the SO2-enriched gases, but little SO2 will be dissolved in the waste water. Sulfur dioxide is absorbed from the SO2-enriched gases by a water shower in a packed tower. The aqueous SO2 solution is then collected and drained into a reservoir from which it may be drawn and pumped into the continuously operating cooling system for the hot burner gases, forming a part of the acid liquor making system. The SO2 is stripped from the solution by contact with the hot burner gases.
APTIC-22203

### RECOVERY OF SULPHUR DIOXIDE FROM GASES.

(Assignee Not Given.) Can. Pat. 375,232. 12p., July 19, 1938. (Appl. date not given, 7 claims).
Raymond Foss Bacon, and Rocco Fanelli.
Identifiers: *Sulfanilic acid, *Absorption (general), United states, Ammonium compounds, Sodium compounds, Sulfites.

A method of recovering sulfur dioxide from gaseous mixtures is described. In previous processes, SO2-containing gases were absorbed by aqueous solutions of weak acid salts. The SO2 forms sulfurous acid which reacts with the dissolved salt forming a sulfite and liberating the weak acid. On heating the solution, the reaction reverses, with the liberation of SO2 and regeneration of the weak acid salt. Sodium and ammonium salts of sulfanilic acid dissolved in water are well-suited for this process. The sulfanilic acid is set free and the solution becomes saturated with acid in an early stage of absorption. Solubility of the acid is small and, as the absorption proceeds, its concentration in solution does not increase. This results in the complete conversion of the salt into sulfite and bisulfite. The SO2-containing gases may be treated with the absorption solution in any manner known in the art of contacting gases and liquids. Absorbed SO2 may be liberated by heating the solution to approximately 100 C. Efficiency in SO2 recovery from the absorption solution is attributed to the solubility relations and the ionization properties of sulfanilic acid. The gaseous product formed by heating the sulfite solution is pure SO2; it may be directly used for an industrial purpose or it may be cooled and compressed to form liquid SO2.
APTIC-22204

### PROCESS OF SEPARATING SULPHUR DIOXIDE FROM GASEOUS MIXTURES.

(Assignee Not Given.) Can. Pat. 335,155. 8p., Aug. 29, 1933. (Appl. Oct. 22, 1932, 5 claims).
Maitland C. Boswell, and George P. Beal.
Identifiers: *Absorption (general), *Amines, Canada, Scrubbers, Design criteria, Organic acids, Cooling, Compressed gases, Vapor pressure.

A process of separating sulfur dioxide from a gaseous mixture is described. In a previous process, quinoline with a proportion of water was used to absorb and react with SO2. The reaction product was dissociated by applying heat to obtain SO2 in the gaseous form. It has been found that bases, not usable before because the product of their reaction with SO2 was a solid, may be used by adding an acid, such as lactic acid, to the water-base complex. Aniline is the preferred base. Freed from dust and sulfur trioxide and cooled to below 30 C, the SO2-containing gas is passed through towers or absorbers containing the aniline-lactic acid-water reagent. The exit gases, containing a small amount of the base vapor, are passed through a tower containing a dilute inorganic acid which removes the base. This acid solution is treated with lime to recover the organic base. Absorbing liquid is passed to a heater where it is raised to 110-125 C to drive off the SO2. The SO2 passes to a cooler and then to a compressor to be collected as liquid SO2. This process has several advantages, such as the low cost of aniline and lactic acid. Also, the lactic acid lowers the vapor pressure of aniline so that the amount of the base in the gases emitted by the absorbing tower is reduced.
APTIC-22205

### RECOVERY OF SULPHUR.

(Assignee Not Given.) Can. Pat. 385,341. 29p., Nov. 28, 1939. (Appl. date not given, 38 claims).
George H. Gleason, and Alfred C. Loonam.
Identifiers: *Absorption (general), *Amines, United states, Bubble towers, Design criteria, Sulfites, Heat transfer, Water.

A method of recovering sulfur dioxide from gas mixtures containing relatively small SO2 concentrations is described. SO2-containing gases are treated with a liquid absorbent, and the absorbed SO2 is expelled, with regeneration of the absorbent, by heating. Dimethyl-aniline, a compound of the aromatic amine class, is used as the absorbent, preferably when free of all diluent substances whether solvent or non-solvent. The absorption treatment is conducted from 10-40 C and at atmospheric pressure. Cooled and cleaned SO2-containing gases are contacted with dimethyl-aniline in a bubble plate tower. Use of the tower allows accurate control of the gas and dimethyl-aniline flow, while providing a sufficiently prolonged and intimate contact period. Waste gases are discharged from the top, and the SO2-containing solution from the bottom, of the tower. The solution is passed through a heat exchanger, where it is heated by the stripped liquor, to the top of a stripping tower. Absorbed SO2 is boiled out by applying heat at the base of the tower. It may flow to a condenser where entrained absorbent vapor may be removed, then to a tower where it is contacted with sulfuric acid to remove the last of the absorbent. This tower may also be used to dry the SO2 or a separate dryer may be used.
APTIC-22206

### ELECTROSTATIC SEPARATION: A BIBLIOGRAPHY.

Contract SBN-900790-23-7, Rept. LR95 (ME), 30p., 1969. 398 refs.
Personal Author Not Recorded.

Identifiers: *Mineral processing, *Electrostatic precipitators, Great britain.

In the period 1960-1964, the high tension separation of minerals was investigated. A bibliography is presented dealing with the electrostatic separation of minerals and the range of minerals that are amenable to such separation.
APTIC-22207

### EFFECT OF THE DUST LOADING ON THE THROUGHPUT AND PRESSURE DROP OF CYCLONE COLLECTORS.

(Einfluss der Staubbeladung auf den Durchsatz und Druckverlust von Zyklonabscheidern). Text in German. Aufbereitungs-Technik, 9 (1):1-8, 1968. 11 refs.
E. Kriegel.
Identifiers: *Dusts, *Operating variables, *Centrifugal separators, Germany, Pressure.

The pressure difference between cyclone entrance and outlet was measured with a manometer and the air quantity after cleaning, with a rotameter. The pressure losses at operation with and without dust load were compared. Upon adding the dust, the pressure loss dropped initially. With higher concentrations, it increased. The decrease of the pressure loss was due to the slowing down of the turbulent flow by the dust. With greater dust quantities, additional friction, impact, and acceleration, losses of the dust particles predominate so that the pressure loss increases again. The pressure losses of the dust-free flow are almost constant. The minimum of pressure loss was found between 1000 and 2000 g/cu m. Based on the theory of similitude the dimensionless resistance, coefficient was computed from the measured pressure loss. As an important geometric critical factor, the dimensionless parameter b/ (D-d) was found.
APTIC-22211

### PRODUCTION OF LOW-SULFUR FUEL OILS FROM SULFUR CONTAINING CRUDE OILS WITH A HIGH AMOUNT OF AROGANOMETALLIC COMPOUNDS DEMONSTRATED BY THE EXAMPLE OF ROMASCHKINO-CRUDE OIL. II.

(Herstellung von schwefelarmen Heizoelen aus schwefelhaltigen Rohoelen mit einem hohen Gehalt an metallorganischen Verbindungen aufgrund eines Beispiels von Romaschkino-Rohoel. II). Text in German. Brennstoff- Chem. (Essen), 49 (10):308-312, Oct. 1968. 5 refs.
R. Kubicka, J. Cir, V. Novak, and J. Veprek.
Identifiers: *Hydrodesulfurization, *Organometallics, Czechoslovakia, Residual oils, Nickel compounds, Vanadium compounds, Catalysts.

Romaschkino crude oil has a high content of asphaltenes. Through their preliminary removal by the Doben method to be explained in a later publication, the efficiency of hydrodesulfurization is improved whereby about 90 to 95% of the asphaltenes can be removed along with significant amounts of organometallic vanadium and nickel compounds. Removal of the asphaltenes speeds up the hydrodesulfurization process and prolongs the life of the catalyst. The separated asphaltenes can be used for mixing with ordinary highway asphalt. Modified NiO-Mo03 or CoO-Mo03 catalysts were used.
APTIC-22212

### STUDY OF THE SULFUR DIOXIDE-ANILINE SYSTEM (I); ABSORPTION ISOTHERMS.

(Studiul sistemului bioxid de sulf-anilina (I); izotermele de absorbotie). Text in Romanian. Studia Univ. Babes-Bolyai, 1 (2):163-171, 1960. 9 refs.
Geza J. Kulcsar, Clara Makkay-Beke, and Ioan Vodnar.
Identifiers: *Aniline, *Isotherms, *Absorption (general), Europe, Sodium chloride, Amines, Temperature.

Using a specially constructed apparatus capable of delivering a flow of sulfur dioxide and nitrogen, held constant at the concentration desired, a SO2-aniline system was studied by passing the gas through a layer containing a 20% aqueous solution of sodium chloride into a layer of aniline above it, then determining the amount of SO2 contained in the gas mixture before and after its passage through the container. From the amount of SO2 retained by the NaCl and aniline, it was possible to construct absorption isotherms. The experiments demonstrated that aniline has a high capacity for absorbing SO2, and even when the gas mixture had a high content of SO2, nearly all of the gas was absorbed. Salt solution is used to avoid the difficulty occasioned by the fact that anhydrous aniline sulfite is not readily soluble in aniline and would form a precipitate on contact with the gas as it emerges from the entry tube, whereas this same sulfite is soluble in the aqueous solution. The SO2 absorbing capacity of aniline increases with a rise in temperature, which is readily absorbable during the final phase of absorption, when the SO2 content of the aqueous solution below the aniline reaches a value of more than 10%. At very low temperatures the anhydrous aniline sulfite dissolves readily in a salt solution, and its solubility continues to increase as temperatures are lowered.
APTIC-22213

### LNG PIPELINES.

Proc. Am. Gas. Assoc. Distribution Conf., 1967, p. 234-242, 13 refs. (Presented at the Am. Gas Assoc. Distribution Conf., St. Louis, Mo., 1967.)
A. R. Duffy, and J. Dainora.
Identifiers: *Pipelines, *Metals, *Natural gas, *Compressed gases, Feasibility studies, Aluminum, Steel, Nickel, Tensile strength.

As determined by a survey of the literature on candidate materials for liquefied natural gas pipelines, transmission of LNG appears to be technically feasible with aluminum alloys (e.g., 5456-0, 5083-0, 6061-T6, 7039-T6), stainless steel (Type 304), and high nickel-content steels (e.g., 9% nickel steel). The impact and tensile properties of these and other materials are illustrated graphically. Aluminum alloys are considered acceptable materials because adequate strengths are readily achieved for reasonable material costs. Since aluminum generally does not experience a transition temperature, resistance to fracture propagation should be satisfactory. Austenitic stainless steels such as Type 304 are recommended because they have a face-centered-cubic lattice and, therefore, no ductile brittle transition temperature. Nine percent nickel steel, whose temperature transition is satisfactory, has the advantage of requiring no expansion loops or bellows. It may not be particularly demanding to insulate an LNG pipeline, Long distance, buried LNG transmission pipelines appear possible with moderate amounts of commercially available materials. Included in the article is a heat transfer analysis which gives an indication of the spacing between coding and pumping stations for various pipe diameters, insulations, and flow rates.
APTIC-22215

### CANVEY ISLAND: UNDERGROUND LIQUID GAS STORAGE.

Consulting Eng., vol. 31:59, 61-62, 64, July 1967.
Personal Author Not Recorded.
Identifiers: *Storage facilities, *Methanes, *Compressed gases, Concrete, Steel, Great britain, Soils, Natural gas, Design criteria, Compression, Heat transfer.

Underground tanks, each with a capacity of 20,000 tons, for the frozen earth storage of liquefied methane were excavated from clay soils. Two concentric rings of freeze tubes were drilled for each tank to a depth of 160 ft. One ring is on the center line of a concrete ring beam designed to restrain the upward pressure of methane vapor; the other is 4 ft from the tank face. Each ring contains 90 tubes that are joined together in a series and connected to a circulating feed and return brine ringmain. Brine solutions are circulated at -26 F from a main heat exchange, ammonia compressor plant. Additional freeze tubes were drilled in the concentric rings to form 45-ft deep ice plugs at the bases of the tanks. One of the principal features of the concrete ring beam is a gas tight seal between the beam and the aluminum dome. The seal was constructed by passing steel reinforced rods through a continuous steel plate cast in the ring beam and bolting aluminum skin to the plate. A seal between the ring beam and the ice wall was effected by bolting another stainless steel plate to the base of the ring beam and embedding the lower half in the ice walls. As a safety measure, a 48-in. water seal is also provided between the ring beam and the frozen ground. Onazote insulates the ring beam from the ice wall and the roof.
APTIC-22230

### OBTAINING SULFUR FROM SULFUR DIOXIDE. 5. PILOT-PLANT EXTRACTION OF SULFUR FROM SULFUR DIOXIDE PRODUCED AT THE CHERNORECHENSKIY PLANT.

(Polucheniye sery iz sernistogo gaza. V. Poluzavodskiye opyty polucheniya sery iz sernistogo gaza, proizvedennyye v Chernorechenskom zavode). Text in Russian. Khim. Prom. Moscow, 8 (14):1-11, 1931. 6 refs.
N. H. Yushkevich, V. A. Karzhavin, and T. T. Krechetov.
Identifiers: *By-product recovery, *So2 removal (combustion products), *Reduction, Ussr, Stack gases, Chemical processing, Pilot plants, Electrostatic precipitators, Hydrogen sulfide, Catalysts, Temperature.

An installation for the bauxite-catalyzed carbon reduction of sulfur dioxide at concentrations of 8.3-9.3% in industrial flue gases is described. The unit yielded up to 1.4 tons of sulfur per day. Flue gas entered the unit at 350-420 C and the reduction process was studied at temperatures of 200-800 C. Losses in the form of hydrogen sulfide were minimum at temperatures of 200-300 C; SO2 excess was 1-1.5%. The use of electroprecipitators is recommended to prevent the 20% loss of sulfur contained in the exhaust gases leaving this unit.
APTIC-22234

### ABSORPTION OF SO2 IN EXHAUST GAS BY WET GAS ABSORPTION APPARATUS.

Kanagawa Prefecture Engineering Experiment Station (Japan), p. 1427. 1968 (*). Translated from Japanese. Franklin Institute Research Labs., Philadelphia, Pa., Science Information Services, 4p., Nov. 11, 1969.
Yoshiyuki Nakai, Tetsuya Yokogawa, and Saburo Kawahara.
Identifiers: *Control equipment, *Absorption (general), Japan, Stack gases, Water, Flow rates.

A small apparatus was designed for contacting sulfur dioxide in exhaust gas with water at the exit of the flue; the absorption effects were studied. A method of nonstationary flow contact by diffusion through a concentric liquid membrane was employed. A small wire net provided a stable liquid membrane. The absorption curve was obtained when the liquid membrane was formed at a certain height and the ratio in weight of the flowing liquid to the contacting gas was varied, and the minimum amount of the flowing liquid at the height of the membrane was calculated. Thus the velocity of absorption was measured. Typical equilibrium curves are presented and discussed.
APTIC-22236

### ENGINE EXHAUST ECONOMICALLY SWEETENS INJECTION WATER.

World Oil, 168 (4):79-80, 83, 86, March 1969. 5 refs. (Presented at the American Society of Mechanical Engineers, Petroleum Mechanical Engineering Conference, 23rd Annual Meeting, Dallas, Texas.)
Wallace J. Frank.

Identifiers: *Injection water, *Engine exhausts, *Scrubbers, *Hydrogen sulfide, Petroleum production, Design criteria, Nitrogen oxides, Oxygen, Catalysts, Cooling, Water, Vapor pressure.

An oil refinery is economically sweetening the sour injection water used for waterflooding with conditioned exhaust gas from electrical generator prime movers. Hydrogen sulfide is stripped from the input stream by a countercurrent flow of inert gas and water in a contact tower. The process is based on first passing cooled exhaust gas through a catalyst to eliminate oxides of nitrogen and free oxygen. When the hydrogen, carbon monoxide, nitrogen oxides, and oxygen in the gas contact the catalyst, the free oxygen and that combinated with nitrogen react to form CO, N2, and H20. As a result, the oxygen and nitrogen oxides are usually reduced to less than one ppm. The treated exhaust gas is again cooled and compressed for use in the contactor column. This column for stripping acid gases is designed in accordance with Henry's law, i.e, the solubility of a gas in a liquid is directly proportional to the partial pressure of the gas in the surrounding atmosphere at a given temperature. This, if partial pressure of H2S in the surrounding atmosphere approaches zero, then when H2S is given adequate opportunity to escape from the water, dissolved H2S will approach zero Countercurrent stripping of gases from water with inert gas provides these conditions. The system described is estimated to cost $46,000 less than an alternate method of sweetening injection water.
APTIC-22243

### MANUFACTURE OF LOW-SULFUR FUEL OIL FROM SULFUR-RICH CRUDE OILS WITH A HIGH CONTENT OF ORGANOMETALLIC COMPOUNDS DEMONSTRATED BY THE EXAMPLE OF ROMASCHKINO-ROHOEL. I.

(Herstellung von schwefelarmen Heizoelen aus schwefelhaltigen Rohoelen mit einem hohen Gehalt an metallorganischen Verbindungen aufgrund eines Beispiels von Romaschkino-Rohoel). Text in German. Brennstoff-Chem. (Essen), 49 (9):268-270, Sept. 1968. 20 refs.
R. Kubicka, J. Cir, V. Novak, and J. Veprek.
Identifiers: *Hydrodesulfurization, *Organometallics, Czechoslovakia, Residual oils, Nickel compounds, Vanadium compounds, Catalysts.

Romaschkino crude oil contains 1.7% by weight sulfur, a considerable amount of bituminous substances and a high concentration of metals such as vanadium and nickel. Comparison with crude oil from Kuwait reveals that the atmospheric distillation residues of Romaschkino crude oil has a lower sulfur content but twice the amount of vanadium and nickel. Dissociation of the asphaltenes is easier with Kuwait crude oil. Nevertheless, it was possible to produce a low-sulfur fuel oil through vacuum distillation. The atmospheric distillation residues were separated into an oil fraction and the bottom residues. The oil fraction was then hydrodesulfurized. A desulfurization from originally 2% by weight to 0.3 or 0.4% S could be achieved. The oil thus prepared can be mixed with the residues from the vacuum distillation to the desired sulfur content. In direct hydrodesulfurization of the atmospheric distillation residues, the asphaltenes reduced the life span of the catalyst to 2000 hours. The bituminous substances were precipitated in the reaction chamber. New catalysts were developed by which the effect of the desulfurization process was improved. But the life span of the catalyst can be prolonged only by removal of the bituminous substances.
APTIC-22247

### EFFECT OF PARTICLE ELECTROSTATIC CHARGE ON FILTRATION BY FIBROUS FILTERS.

Ind. Eng. Chem. Process Design Develop., 4 (4):345-348, Oct. 1965.
D. A. Lundgren, and K. T. Whitby.
Identifiers: *Fibrous filters, *Electric charge, Aerosols, Particle size, Filters, Instrumentation, Mathematical analyses.

The influence of electrostatic charge on particle removal from a gas by a fibrous filter was quantitatively measured as a function of particle diameter, particle charge, filter fiber diameter, and air flow velocity. Experiments were conducted using homogeneous, monodispersed, solid spherical aerosol particles purposely charged, to various degrees, by a special corona charger. Particle charge magnitude and uniformity were measured with an aerosol charge spectrometer. At certain experimental conditions, particle charges cause a tenfold increase in the single fiber efficiency which, in turn, leads to a hundredfold decrease in filter penetration. A functional relationship exists between the single fiber efficiency and a dimensionless image force-drag force parameter. A method is presented for calculating the effect of particle charge on collection by a neutral filter for any given set of conditions. (Author abstract modified)
APTIC-22254

### IMPROVEMENTS RELATING TO THE RECOVERY OF SULPHUR FROM GAS MIXTURES CONTAINING HYDROCARBONS.

(Anglo-Iranian Oil Co., Ltd., London (England)) Brit. Pat. 697,672. 6p., Sept. 30, 1953. 4 refs. (Appl. Jan. 3, 1951, 14 claims).
John Norman Haresnape, and Kenneth Shephard Cuddington.
Identifiers: *Adsorption (general), *Hydrogen sulfide, Great britain, Stack gases, Natural gas, Petroleum refining, So2 removal (combustion products), Hydrocarbons, Sulfur compounds.

A process for recovering sulfur from natural gas containing hydrogen sulfide, from gas streams from petroleum refining operations containing hydrocarbons, hydrogen, and H2S, and from flue gas streams containing sulfur dioxide is described. It is known that H2S and SO2 react to form water and elemental sulfur. However, this reaction is highly exothermic and cannot be conducted in the presence of hydrocarbons. An inexpensive method of conducting the reaction was developed which does not require the concentration of H2S or the reduction of hydrocarbons. A gas stream containing H2S, SO2, and hydrocarbons is passed over a bed of alumina or bauxite at a temperature of approximately 150 C until the contact agent is saturated with sulfur. At this time the passage of the gas is stopped and the sulfur removed. The gas is passed upwardly through the bed so that liquid sulfur draining from the bed does not cover unused surfaces and thus reduce the activity of the alumina. It is possible to recover all the sulfur from a gas stream containing 6% and 3% by volume of H2S and SO2, respectively, at a space velocity of 10,000 v/v/hr. Sulfur may be removed from the bed by raising the temperature above 500 C, or by means of a solvent, such as benzene or cumene. The reaction proceeds satisfactorily in the presence of methane, ethane, propane, butane, and higher hydrocarbons without undesirable side reactions.
APTIC-22257

### A PROCEDURE FOR THE DETERMINATION OF MINIMUM CHIMNEY HEIGHTS.

For primary bibliographic entry see Field 14.
APTIC-22258

### A METHOD OF PRODUCING SULPHUR THROUGH REDUCTION OF GASES CONTAINING SULPHUR DIOXIDE.

(Assignee Not Given.) Brit. Pat. 437,236. 4p., Oct. 25, 1935. (Appl. March 5, 1935, 7 claims).
Axel Rudolf Lindblad.
Identifiers: *By-product recovery, *So2 removal (combustion products), *Reduction, Sweden, Combustion gases, Sulfur oxides control, Sulfur compounds, Catalytic activity.

In an improved method of recovering sulfur from roasting furnace gases or gases evolved from the oxidation of pyrites, the sulfurous gases and a suitable quantity of oxygen are first reduced in a generator charged with carbon or other carbonaceous material impregnated with an alkali metal compound such as sodium carbonate. While still hot, the reducing gas mixture thus obtained is passed to a reaction chamber, heated to 500-800 C, filled with brick, bauxite, or other material containing iron. In the reaction chamber, the sodium compound is separated from the gas mixture and deposited on the contact material, forming an extraordinarily active contact. Since the supply of the sodium compound is continuous, the catalytic material always presents a free contact surface to the gas mixture. The sulfur formed by the reaction between the reducing gases and sulfur dioxide in the reaction chamber is separated in coolers and Cottrell apparatus.
APTIC-22259

### EFFECT OF SURFACE-ACTIVE SUBSTANCES ON ABSORPTION RATE OF SULFUR DIOXIDE IN WATER UNDER STATIC CONDITIONS.

Compt. Rend. Acad. Bulgare Sci., 16 (3):269-272, 1963. 4 refs.
D. Elenkov, S. Ikonpissov, and N. Nankov.
Identifiers: *Absorption (general), *Reaction kinetics, *Surfactants, Europe, Water.

Experiments were conducted to investigate the effect of surface-active substances on the absorption rate of pure sulfur dioxide in water in double conic vessels and in cylindrical vessels. The surface active agents were neccal BX and dodecylbenzesulfonic acid. The results, which are presented in the form of graphs, indicate that the shape of the vessel considerably influences the absorption rate and that the surface-active substance can increase the absorption rate (above 500 rpm) or reduce it, depending on changes in stirring rate. The results are attributed to the effect of complex hydrodynamics.
APTIC-22260

### OVER-THE-ROAD TRANSPORTATION OF LIQUID METHANE.

American Gas Association, Inc., New York, Proc. Am. Gas Assoc. Distribution Conf., St. Louis, Mo., 1967, p. 228-233. (May 1-4.)
B. M. Ambler.
Identifiers: *Trucks, *Methanes, *Compressed gases, Costs, Natural gas, Transportation, Vehicles, Design criteria.

While pipeline supply of natural gas will continue to be the predominant answer to the efficient movement of natural gas within the U. S., there are other ways to distribute natural gas. One method, which will allow the gas industry to meet peak shaving needs and to cope with temporary interruptions of pipeline service, is over-the-road transportation of liquid methane in tank trailers at approximately -260 F and atmospheric pressures. A typical double-walled tank trailer has an inner tank constructed of stainless steel, aluminum, or other metal suitable for low-temperature service. The outer tank, which is integral to the trailer, is made of carbon steel designed for vacuum service. The annular space between the tanks is filled with perlite and a moderate vacuum is established to effectively insulate the liquid methane. Standard safety features include relief valves on the liquid 'fill and discharge' line, the gas 'return and discharge' line, and the vapor line. At the point of use, the liquid can be transferred to a storage tank or vaporized and sent directly to a pipeline.
APTIC-22261

### RECOVERY OF SULPHUR DIOXIDE FROM GASES.

(Assignee Not Given.) Can. Pat. 375,230. 9p., July 19, 1938. (Appl. date not given, 3 claims).
Raymond Foss Bacon, and Rocco Fanelli.
Identifiers: *Absorption (general), *Organic acids, United states, Primary metallurgical processing, Ammonium compounds, Sulfites, Temperature.

A process for the recovery of sulfur dioxide from gaseous mixtures is described, in which SO2-containing gases are treated with an absorbing liquid and the absorbed SO2 is expelled by heating. It is particularly suitable for the treatment of gas mixtures containing relatively small concentrations of sulfur dioxide, such as gas mixtures resulting from the roasting of pyrites and other sulfide ores, while an effective and economical method is provided for producing SO2-bearing reagents for various chemical and metallurgical uses. Any water insoluble weak acid salt capable of reacting with SO2 to produce sulfites may be used. The acid should be stable and non-volatile under the SO2 absorption and liberation conditions. Alkali metal and ammonium salts of benzoic, fumaric, phthalic, and salicylic acids are recommended. The SO2-bearing gases may be treated with the absorption solution in any manner known in the art of contacting gases and liquids. Sulfur dioxide may be liberated by heating the solution to any suitable temperature between the absorption temperature and the boiling temperature of the solution. The salt used should be one which forms a sulfite from which SO2 may be readily liberated by heating to temperatures above the absorption temperature.
APTIC-22264

## RECOVERY OF SULPHUR DIOXIDE FROM GASES.

(Assignee Not Given.) Can. Pat. 375,231. 9p., July 19, 1938. (Appl. date not given, 3 claims).
Raymond Foss Bacon, and Rocco Fanelli.
Identifiers: *Absorption (general), *Organic acids, United states, Primary metallurgical processing, Scrubbers, Ammonium compounds, Sulfites, Temperature.

A process for the recovery of sulfur dioxide from gaseous mixtures is described, in which SO2-containing gases are treated with an absorbing liquid and the absorbed SO2 is expelled by heating. Aqueous solutions of the salts of weak acids capable of reacting with SO2 to produce sulfites may be used. A greater and more rapid recovery of SO2 from weak acid salt solutions may be obtained by maintaining a free weak acid in the absorption solution. The weak acid from which the salt is formed should be stable and non-volatile under the absorption and SO2-liberation conditions; it may be water soluble or water insoluble. The free weak acid should be soluble in the solution. Alkali metal and ammonium salts of organic acids are preferred. The water-soluble salt of a water-soluble acid should be used and the free acid should be the same as that forming the salt. SO2-bearing gases may be treated with the absorption solution in any manner known in the art of contacting gases and liquids. They may be passed over the surface of a body of solution, with continuous or intermittent agitation of the solution, bubbled through the solution, or passed through a packed tower in contact with one another. The absorbed SO2 is liberated by heating the solution to any temperature from the absorption temperature to the boiling temperature. The gaseous product is pure SO2 and it may be used for an industrial purpose or it may be cooled and compressed to form liquid SO2.
APTIC-22265

## TANK-WITHIN-A-TANK STORES LNG.

Eng. News-Record, 1965:175, Oct. 14, 1965.
Personal Author Not Recorded.
Identifiers: *Storage facilities, *Natural gas, *Compressed gases, Concrete, Steel, Nickel, Soils.

Two methods of liquefied natural gas (LNG) storage in use are the underground pre-stressed concrete tank and the frozen-earth underground storage, which is basically a structural cap for a hole in the ground. These units can only be built where soil conditions are favorable. Two recently designed tanks are described that have virtually no limitations on location. One stands on a sand mat and the other, in an area of low soil bearing values, rests on piles. Each tank is actually a tank within a tank, having an inner tank made of 9% nickel steel and an outer tank of A 283 Grade C carbon steel. Perlite, a fine granular material thermally expanded from a volcanic rock, is packed in the space between the tanks to serve as an insulator. Both tanks have capacities of 175,000 barrels, the equivalent of 600 million cu ft of gas. Both have flat bottoms and dome tops. The tanks are surrounded by dikes large enough to contain 150% of their contents. The dike area is graded so that any stored LNG draining from the tank will flow to a remote ponding area.
APTIC-22271

## REMOVAL AND RECOVERY OF SULPHUR FROM SMELTER GASES, I.

Chem. Age (New York), vol. 43:249-251, 255, Nov. 30, 1940. Part II. Ibid., vol. 43:259-261, Dec. 7, 1949. Part III. Ibid., vol. 43: 273-275, Dec. 14, 1940. 20 refs.
D. D. Howat.
Identifiers: *Primary metallurgical processing, *By-product recovery, *Absorption (general), Stack gases, Scrubbers, Sulfur compounds, Catalysts, Reduction.

Sulfur, probably the most commonly occurring nonmetallic element in ores, is oxidized almost entirely to sulfur dioxide in normal smelting operations. In 1929 alone, the wastage of sulfur in smelter gases almost equalled the world supply of natural sulfur, constituting about one-third of the total sulfur used in any form. As a preliminary to the recovery of sulfur, it is frequently necessary to treat smelter gases with some suitable absorbent in which the sulfur dioxide becomes concentrated; the gas is liberated in some subsequent step, and the absorbent is regenerated and returned to the scrubber. Part I of this three-part report reviews the two reactions, air oxidation and autooxidation, involved during the process of absorption and regeneration and summarizes methods of absorption suitable for application on a commercial scale. The methods employ aqueous solutions of ammonium sulfite and bisulfite, aluminum sulfates, or organic amines. Part II discusses the capacities of the absorbing solutions, processes for the regeneration of the sulfur dioxide, and the reduction of sulfur dioxide by coke to elemental sulfur. Among the regeneration processes, special attention is given to the Lurgi process, in which hydroxides and carbonates of metal alkalies are added to base solutions of arylamines, and to a method of chemical regeneration by means of zinc oxide. Part III deals with the catalytic reduction of sulfur dioxide by carbon monoxide and carbonyl sulfide. The catalysts used in the processes described are ferric oxide, hydrated alumina oxide, sintered alumina, and bauxite.
APTIC-22273

## CONVERSION OF SULPHUR DIOXIDE TO SULPHUR TRIOXIDE.

(Imperial Chemical Industries Ltd., London (England)) U. S. Pat. 2,799,560. 4p., July 16, 1957. 8 refs. (Appl. Sept. 7, 1954, 11 claims).
Phineas Davies.
Identifiers: *Catalytic oxidation, *So2 removal (combustion products), Great britain, Combustion gases, Potassium compounds, Vanadium compounds, Oxides, Silicon compounds, Catalysts, Cooling, Ph, Temperature.

The oxidation of sulfur dioxide to sulfur trioxide and the production of a catalyst for this process are discussed. The SO2 and a gas containing free oxygen are contacted with a catalyst consisting of the oxides of vanadium, potassium, and silicon. The catalyst is produced by adding potassium silicate to dilute sulfuric acid to produce silica gel which is mixed with a soluble vanadium compound such as vanadyl sulfate, vanadyl chloride, vanadyl oxalate, and ammonium vanadate. The silica and insoluble vanadium compound are co-precipitated by adding ammonium hydroxide. The vanadium content of the catalyst is 6 to 7.5% by weight. If the reaction is initiated at 380 C, the potassium: vanadium ratio, expressed as the molar ratio K2O:V2O5, should be 5.4:1; at 390 C, the ratio should be 5.0:1; and at 400 C, the ratio should be 4.5:1. The oxidation is conducted in three sucessive zones. The inlet temperature of each zone is about 380 C, and the exit temperatures decrease from the first to the third zones. The catalyst composition is varied in each zone to give the maximum conversion of SO2 to SO3.
APTIC-22274

## SULFUR RECOVERY PROCESS.

(Assignee Not Given.) Brit. Pat. 895,503. 12p., May 2, 1962. (Appl. Aug. 29. 1958, 11 claims).
Francis Mark Townsend.
Identifiers: *Sulfur dioxide, *Hydrogen sulfide, *Reduction, Great britain, Natural gas, Operating variables, Absorption, Alcohols, Esters, Ethers, Vapor pressure.

A process for removing hydrogen sulfide from sour natural gas and recovering, as elemental sulfur, the sulfur content of the H2S is described. The gaseous mixture is contacted with sulfur dioxide in an aqueous solution of an organic solvent. The aqueous solution contains 90% to 99% organic solvent by weight, the vapor pressure of which at 20 C is not more than 10 mm Hg, and in which the solubility of water is not less than 2% by weight at 20 C. The organic solvent is a compound containing at least two atoms of one element other than carbon and hydrogen, at least one of which is oxygen or sulfur, and containing no more than two vicinal hydroxyl radicals. Preferred solvents are diethylene glycol, triethylene glycol, propylene glycol, and their ethers and esters. A reaction occurs between the H2S and SO2 to form a precipitate of sulfur particles in the reaction medium. Water vapor is absorbed by the aqueous solution of the organic solvent. The ratio of H2S to SO2 is 2:1 by volume. The organic solvent is regenerated by distillation to remove the absorbed water and recycled into the process. Precipitated sulfur is removed by heating the reaction medium to a temperature above the melting point and below the sublimation temperature of sulfur. This causes an agglomeration of the particles so that they settle and can be decanted off. Unlike previous methods, this approach has been developed around basic reactions which are economically attractive for small scale production, or for removing the H2S from gases in which it is present only in minute amounts.
APTIC-22278

## TREATMENT OF IRON PYRITES FOR RECOVERY OF SULPHUR AND FORMATION OF IRON OXIDE.

(Assignee Not Given.) Brit. Pat. 403,961. 9p., Jan. 1, 1934. (Appl. June 30, 1932, 7 claims).
Stanley Isaac Levy.
Identifiers: *Pyrites, *So2 removal (combustion products), Great britain, Combustion gases, Coal, Coke, Mineral processing, By-product recovery, Design criteria, Iron oxides, Sulfur compounds, Oxidation, Reduction, Condensation, Temperature.

The recovery of sulfur and iron oxides from pyrites by an oxidizing and a reducing step is described. Oxidation is accomplished by causing finely divided pyrites to fall continuously at a uniform rate through a combustion chamber. Air is introduced continuously in a quantity insufficient for the complete combustion of the mineral. A reaction between the pyrite and the oxygen of the air occurs to form iron oxide, sulfur dioxide, and free sulfur. The chamber is insulated and the rate of entry of mineral and air are so adjusted that the exit gases are at a temperature of approximately 1000 C. Gases then pass through a reducing zone, and are contacted with finely divided coal, coke, or charcoal. Most of the sulfur dioxide is reduced to elemental sulfur with the information of carbon dioxide. The gases passing from the reducing zone contain, as sulfur vapor, most of the sulfur originally introduced in the form of pyrites. They are passed through suitable dust chambers, con-

densers, and scrubbers so that the elemental sulfur may be removed. It is recommended that the combustion and reduction chambers be contained in one structural unit.
APTIC-22279

### EXHAUST GAS OXIDATION ON VANADIA-ALUMINA CATALYSTS.

J. Air Pollution Control Assoc., 11 (8):369-373, Aug. 1961. 9 refs. (Presented at the American Institute of Chemical Engineers, Washington, D. C., Dec. 1960.)
W. B. Innes, and R. Duffy.
Identifiers: *Engine exhausts, *Catalytic oxidation, *Reaction kinetics, Hydrocarbons, Aluminum compounds, Vanadium compounds, Carbon monoxide, Catalytic activity.

An approach is outlined for studying the kinetics of exhaust gas oxidation, with data on vanadia-alumina catalysts. The data fit first-order kinetics, and the activation energy for pure olefin oxidation by excess air is about 17 Kcal and that for carbon monoxide is 21 Kcal/mol. Oxidation rate constants in exhaust gas appear about equal to the product of the pure gas constant times the fraction of vanadium in the pentavalent state, except for pentane and hexane which are much lower. The rate constant for pure compound oxidation increases markedly with degree of of unsaturation and molecular weight. Activity for oxidation of ethene at 405 C and propene at 325 C directly correlates with V205 content up to 24%. On thermal deactivation, oxidation activity normally increases or stays constant down to about 70 sq m/gram and thereafter is proportional to surface area. (Author summary modified)
APTIC-22281

### CAVERN STORAGE OF LIQUEFIED NATURAL GAS.

Proc. Am. Gas Assoc. Operating Section Conf., 1962, CEP-62-12, 4p. (Presented at the Am. Gas Assoc. Operating Section Conf., 1962.)
H. Bresson.
Identifiers: *Storage facilities, *Natural gas, *Compressed gases, Feasibility studies, France, Design criteria, Heat transfer, Liquids.

Preliminary theoretical studies on underground storage of liquefied natural gas are reported, together with the results of three pilot-scale cavern excavations and preparatory design plans for an industrial-scale reservoir. The theoretical studies indicated that heat insulation would take up a major part of the temperature drop caused by cooling with liquid nitrogen and would, therefore, substantially reduce soil stress and prevent cracking of the rock around the cavity. In the cavern experiments, the porous concretes intended to act as heat insulation failed to perform their function due to their high water content. Experiments suggested the advisability of constructing a reservoir in rock with no access to water and of avoiding moisture in the reservior at the time of cooling. Satisfactory results were obtained when excavations were closed with concrete floors on which water admitted to the pit froze to ice. In this way, it was possible to pressurize an excavation made in marl and to tap off quantities of liquid nitrogen. As determined by the cavern studies, the two main problems involved in underground storage concern heat exchange between surrounding rock and stored liquid and the movement of temperatures in liquid and gas phases. These problems were solved with the help of empirical heat exchange formulas, the solutions forming design criteria for the industrial reservoir now contemplated.
APTIC-22282

### MATERIALS PROBLEMS IN AUTOMOTIVE EXHAUST REACTORS FOR POLLUTION CONTROL.

National Aeronautics and Space Administration, Cleveland, Ohio, Lewis Research Center, Proc. Conf. Aerospace Structural Materials, Cleveland, Ohio, 1969, p. 317-330. 3 refs. (Nov. 18-19, Paper 22.)
Robert E. Oldrieve, and Neal T. Saunders.
Identifiers: *Afterburners, *Engine design modification, Ceramics, Corrosion, Metals, Engine exhausts, Design criteria, Hydrocarbons, Carbon monoxide, Oxidation, Temperature.

Major contributors to air pollution from automobile engines include hydrocarbons (HC) and carbon monoxide. Automobile exhaust reactors (afterburners) have shown good potential for reducing these pollutants by oxidizing the HC and CO to water vapor and carbon dioxide. From the oxidation process, the exhaust reactors reach temperatures from about 1600 to 1900 F under normal driving conditions. This high-temperature oxidizing environment in combination with other corrosive constituents in the exhaust gas such as lead present a severe environment for reactor materials. Programs directed toward development of materials for use in automobile exhaust reactors are described. Both metallic and ceramic materials are being considered. The current status of the materials development planned as well as the status of other development work in this area are described. In addition, factors affecting materials selection for use in the reactors are reviewed. (Author abstract modified)
APTIC-22287

### PROGRESS IN L.N.G. STORAGE AND TRANSPORT.

Natur. Gas L.P.G., 1 (5):5-36, Aug. 1968.
Personal Author Not Recorded.
Identifiers: *Storage facilities, *Natural gas, *Compressed gases, Costs, Great britain, Ships, Trucks, Design criteria.

Liquefied natural gas will be taken by road tanker from Canvey Island, where supplies are imported from Algeria by sea, to facilities at Ambergate in which will be stored 5000 tons of LNG or the equivalent of 250 million cu ft of gas. When completed, the storage tank will be capable of manufacturing from oil about 100 million cu ft of gas/day. The equivalent of 1000 million cu ft of gas, or 20,000 tons of liquid, will be contained in one storage tank at Glenmavis. Such plants will ensure that sudden peak demands could be met in winter. On the Glenmavis site, the Gas Council plans to build the storage tank, liquefaction plant, control building, compressor house, generator house, and 150 ft high radio mast for use in the national system for telemetric control of gas transmission. Some 700,000 tons of Algerian liquefied natural gas, which is equivalent to about 365 million therms, have been imported into the U. K. since 1964. At the Canvey Island methane terminal, 22,000 tons of gas are stored in seven conventional above-ground storage tanks, and four additional in the ground units are planned. Frozen ground storage permits a much more rapid rate of withdrawal than would be economic either in the case of North Sea gas, or in the case of underground storage in aquifers such as that planned at Sarsden in the Cotswolds. Improved methods of carrying gas is the liquid phase across the sea were investigated, and the economic advantage claimed for the membrane tank is that it offers a capital saving of up to 15% coupled with a small reduction in ship's operating costs due to better utilization of the cargo space. A thin, flexible, metal lining is used to contain the cargo, with the load being transferred to the ship's structure by means of load-bearing insulation.
APTIC-22288

### CLEVELAND -- THE CENTER OF THE NATURAL GAS INDUSTRY.

Chem. Eng. News, 22 (5):326-329, March 10, 1944.
Mathew M. Braidech.
Identifiers: *Design criteria, *Compression, *Natural gas, *Compressed gases, Ohio, Heat transfer.

The world's first liquefaction-storage plant, which was built in Cleveland in 1941, was originally designed with a liquefaction capacity of 4,000,000 cu ft/day and with a varying regasification rate up to 70,000,000 cu ft/day. Natural gas is first compressed to a relatively high pressure and freed of carbon dioxide and water, which would otherwise solidify at the subsequent lower temperatures and clog the piping and other equipment. The gas is next cooled to about -140 F by a cascade system of refrigeration using ethylene and ammonia, as well as by gas flash heat-exchangers. It is then allowed to expand suddenly in two stages to about 3 lb as it passes into the heavily insulated storage vessels, where the gas is supercooled to -250 F with the formation of the liquid. Three spherical storage tanks are made of two concentric spheres separated and insulated by 3 ft of cork insulation. The liquefaction process and refrigeration equipment are described. Regasification equipment consists of three special pumps, which raise the pressure of the liquid in the tanks to a pressure sufficient to force it into the three live steam liquid gas heaters, and against 30-lb gas gauge pressure carried in the city high-pressure feeder lines. Cold gas from the regasification units goes to a heater, using exhaust steam from the pumps, for the purpose of raising the temperature of the gas from about zero to 50 F. A boiler plant suitable to produce 62,000 lb of steam per hour is provided, and is equipped for either natural gas firing during the liquefaction periods when excess natural gas is available, or for oil firing during regasification periods when there is a scarcity of gas. Gas appliance production and the American Gas Association Testing Laboratories are also mentioned.
APTIC-22289

### GAS ABSORPTION CAPACITY OF VENTURI SCRUBBER.

(Ventsuri skurraba ni yoro gusu kyushu).
Mitsubishi Heavy Industry, Ltd., Tech. Rev., 3 (3):1-7, 1966. 11 refs. Translated from Japanese. Belov and Associates, Denver, Colo., 26p., May 23, 1970.
Personal Author Not Recorded.
Identifiers: *Venturi scrubbers, *Absorption (general), Japan, Stack gases, Boilers, Fuel oils. Steam plants, Operating variables.

The effect of a venturi scrubber on the gaseous effluent of a power plant is described. Special characteristics of the scrubber, and the nature of flow of the scrubbing liquid are discussed. The scrubbing liquid consists in part of limestone, manganese oxide, and water. Previous experiments on the capacity of the venturi scrubber as a gas absorbent are limited by small scale installations. The experiment described is conducted on a scaled-up version of a fuel-oil boiler. The effect of operating variables on each factor of gas absorbing capacity is analyzed. Graphic illustrations of changes in one parameter in terms of another one are included.
APTIC-22291

### SPECIAL STUDIES FOR INCINERATORS FOR THE GOVERNMENT OF THE DISTRICT OF COLUMBIA.

For primary bibliographic entry see Field 01.
APTIC-22296

### SMELTING SULPHIDE ORES TO RECOVER ELEMENTAL SULPHUR THEREFROM.

(Assignee Not Given.) Brit. Pat. 389,520. 5p., March 20, 1933. (Appl. Sept. 18, 1931, 9 claims).
Raymond Foss Bacon.
Identifiers: *Blast furnaces, *Primary metallurgical processing, *By-product recovery, *Sulfur compounds, Combustion gases, Operating variables, Sulfur oxides control, Iron compounds.

By reducing the amount of sulfur dioxide formed in the combustion zone and preventing the oxidation of sulfur, this invention provides a means of increasing the yield of elemental sulfur recovered

from pyrite smelting furnaces. The process is carried out in a furnace with a closed top to avoid ingress of air above the charge, an admixture of pyrite, coke and ferrous sulfide. Since the controlled blast produced an elongated hot zone, the height of the charge is increased to prolong the contact, in the presence of a catalyst such as magnesia, dolomitic lime or lime, between the iron sulfide in the charge and sulfur dioxide. The prolonged contact effects a substantial reduction of the sulfur dioxide to sulfur within the furnace. Further elemental sulfur is distilled from the ore.
APTIC-22298

### DELIBERATIONS AND STUDIES ON THE FILTRATION OF DUST-LADEN GASES WITH SPECIAL ALLOWANCE FOR ELECTRIC FORCES.

Staub (English translation from German of: Staub, Reinhaltung Luft), 29 (12): 1-13, Dec. 1969. 14 refs.
CFSTI: TT 69-55002/12
Wilhelm Walkenhorst.
Identifiers: *Dusts, *Electrostatic precipitators, Germany, Design criteria, Electrical properties.

Electric forces can be advantageously used for cleaning gases containing dust, because they are, in general, many times greater than mass forces. A new proposal is made to produce an inhomogeneous electric field of sufficient intensity. The separation effect in the case of a laminar air flow is demonstrated by simple model experiments in which single and double conductors are used. The local distribution of dust after passing wires is made visible on a diaphragm filter. Charges on the wire surface produce electric fields of high intensity, while the particle charges influence the separation. It is shown by means of a test precipitator that the results obtained for a model are correct. According to this, it is possible to construct precipitators of high flow resistance and high separation efficiency also for fine dusts. In the case of good insulation of wire surfaces, and if water-repellents are used for the protective layers, no difficulties occur in the operation of these precipitators even if the air is saturated with moisture. (Author abstract)
APTIC-22311

### NEW STEEL DESIGN CONCEPTS FOR LIQUEFIED NATURAL GAS STORAGE.

For primary bibliographic entry see Field 10.
APTIC-22314

### LIQUEFIED NATURAL GAS STORAGE IN ABOVE GROUND TANKS.

American Gas Association, Inc., Proc. Am. Gas Assoc. Operating Section 1962, 4p.
M. B. Clapp, and I. L. Wissmiller.
Identifiers: *Storage facilities, *Natural gas, *Compressed gases, Aluminum, Steel, Nickel, Methanes, Ethylene, Hydrogen, Nitrogen, Oxygen.

Field-constructed spherical and cylindrical tanks are described that permit the safe storage of liquid hydrogen, nitrogen, oxygen, methane, and ethylene. All the tanks are aboveground and consist of an inner tank designed to hold the cold liquid and an outer tank designed to confine the insulation. The spherical tanks discussed are used in the storage of liquid ethylene, oxygen, nitrogen, and hydrogen. Their outer shells are carbon steel and their inner shells are stainless steel or aluminum. Consideration is now being given to 9% nickel steel. It is estimated to be competitive with stainless steel and aluminum at about 50,000 barrel capacity and more economical in single storage tanks larger than 50,000 barrels. The spheres are supported on tubular columns or high strength rods. Special attention was paid to the insulation space used in the liquid hydrogen tank. The space was evacuated to a pressure of about 10 micron of mercury and a special grade of perlite fill was used. By this means, the thermal conductivity of the insulation was reduced by a 30-to 1 ratio compared with nonevacuated perlite fill employed in other spheres. Re-evacuation of the insulation space is required only at intervals of several years. The design considerations of the spheres are common to the flat-bottom, cylindrical tanks built for liquid methane and oxygen.
APTIC-22321

### IMPROVEMENTS IN AND RELATING TO THE MANUFACTURE OF SULPHUR.

(Societe Generale Industrielle et Chimique du Katanga, Brussels (Belgium)) Brit. Pat. 471,668. 5p., Sept. 2, 1937. (Appl. Jan. 2, 1936, 3 claims).
Marcel Pourbaix.
Identifiers: *By-product recovery, *So2 removal (combustion products, *Reduction, Carbon black, Belgium, Combustion gases, So2 removal (combustion products), Hydrogen, Sulfur compounds, Carbon disulfide, Hydrogen sulfide, Steam.

A process for recovering maximum amounts of sulfur from sulfur dioxide and/or sulfur trioxide containing gases reduced by carbon, hydrogen, or steam is based on experimental observations that SO2 concentrations in reduced gases should equal the sum of the concentrations of H2S, CS2, and COS in the reduced mixtures. The process entails reacting sulfurous gases with a substance containing H2 and/or C in free or combined form so that, after separation of the free sulfur produced, the concentrations of COS, H2S, and CS2 in the resulting mixture satisfy the relation SO2 (COS plus H2S plus CS2) equals 1. Thus, when gas is treated with carbon in the absence of hydrogen, the ratio between the SO2 concentration and the COS plus SO2 concentration should be substantially equal to 1. When the gas is reduced by hydrogen or H2S in the absence of carbon, the ratio of concentrations of SO2 and H2S should be substantially 1. Again, when a SO2 gas is treated with both carbon and hydrogen compounds, the relative SO2 concentrations and COS plus H2S plus CS2 concentrations should be about equal to 1.
APTIC-22322

### DEVELOPMENT OF A MOLTEN CARBONATE PROCESS FOR REMOVAL OF SULFUR DIOXIDE FROM POWER PLANT STACK GASES. SUMMARY REPORT.

Contract PH 86-67-128, Rept. AI-68-104, 165p., Feb. 1968. 8 refs. CFSTI: PB 179908
Personal Author Not Recorded.
Identifiers: *Steam plants, *Absorption (general), *Carbonates, Corrosion, Stack gases, Scrubbers, Lithium compounds, Potassium compounds, Sodium compounds, Sulfites, Reduction.

A molten carbonate process to remove sulfur dioxide from power plant stack gases is described wherein the sulfur oxides are absorbed in a molten mixture of lithium, sodium, and potassium carbonates. The resulting carbonate-sulfite mixture is then regenerated chemically. Developmental effort is in four major areas: process chemistry, including absorption, reduction, and regeneration; corrosion studies, to determine suitable construction materials; contactor development, specifically scrubbers; and component development. Work has been initiated on pilot plant and component test loop design. (Author summary modified)
APTIC-22327

### DESULPHURIZATION OF COKE-OVEN GAS AT APPLEBY-FRODINGHAM.

J. Inst. Fuel (London), vol. 31:319-324, July 1958. 4 refs.
L. Reeve.
Identifiers: *Coke-oven gas, *Desulfurization of fuels, Steel, Great britain, Fuel gases, Furnaces, Primary metallurgical processing, Absorption, By-product recovery, Sulfuric acid, Iron compounds, Oxides.

A fluidized iron-oxide process operating at 350-400 C was developed to desulfurize crude coke-oven gas used in steel furnaces. The sulfided ore is conveyed to a regenerator chamber where it is oxidized in a current of air at 600-800 C, the exit gases is suitable for sulfuric acid manufacture. No oxygen is added to the incoming gas. The regenerated oxide is returned to the absorber where it provides about one-third of the heat requirements of the process; the remainder is obtained by heat exchange of the cold incoming crude gas against outgoing hot desulfurized gas. The process has been in operation for over two years on the scale of approximately 2 1/2 million cu ft. Over 95% sulfur absorption has been achieved from gas containing 600 grains H2S per 100 cu feet in conjunction with the removal of about the same percentage of organic sulfur. With respect to the sulfur content of steel, the desulfurized coke-oven gas has improved sulfur removal from the furnaces by 0.006-0.007%.
APTIC-22365

### RECLAIMER REGENERATION PROCESS CAN CUT MEA LOSSES.

Oil Gas J., 66 (9):87-88, Feb. 26, 1968. 1 ref.
Allen D. Shell.
Identifiers: *By-product recovery, *Amines, Chemical processing.

As the size of gas treating plants continues to grow, the operation of amine reclaimers, particularly regeneration, becomes increasingly important. In addition to conserving amine, regeneration can minimize drain line and disposal problems caused by reaction of the alkaline MEA with zeolite brine to form calcium scale. Regeneration consists of feeding water to the reclaimer, recovering the overhead vapors, and finally dumping the remaining contaminated solution. The reclaimer operation is reversed to accomplish regeneration. This procedure recovers MEA without additional costs.
APTIC-22368

### DISCHARGE LIMITATION FOR REFUSE INCINERATORS. (FWDP 12). APPENDIX C.

For primary bibliographic entry see Field 01.
APTIC-22389

### RECOVERY OF SULPHUR IN SOLID COMPOUNDS BY THE ADDITION OF AMMONIA AND WATER VAPOR TO SMELTER GAS.

Bureau of Mines, Washington, D. C., Rept. of Investigation 3339, p. 31-40, May 1937. 5 refs.
G. W. Marks, and P. M. Ambrose.
Identifiers: *By-product recovery, *Absorption (general), Stack gases, Primary metallurgical processing, Precipitation, Ammonia, Sulfates, Sulfites, Vapors, Temperature.

Although various processes for the recovery of sulfur dioxide by means of ammonia solutions have been described, apparently no previous attempt has been made to devise a procedure whereby ammonia gas is introduced into the smoke and the sulfites are recovered in solid form. From an economic aspect, such a process would have to be cyclic to permit the ammonia to be used again. The efficacy of such a procedure depends, among other things, upon the completeness of precipitation of the ammonium sulfites, the degree of oxidation of these sulfites, and the recovery of ammonia and sulfur. The best conditions for precipitating the solid compounds are described, and the losses that would be incurred at different temperatures are noted. The latter part of the cycle, where the sulfur is obtained and the ammonia gas recovered, is not discussed. (Author abstract modified)
APTIC-22392

### A CORRELATION BETWEEN SINGLE FIBER EFFICIENCIES OF FIBROUS FILTERS AND OPERATING VARIABLES.

Am. Inst. Chem. Engrs. J., 8 (5):704-708, Nov. 1962. 14 refs.
Shuichi Aiba, and Takeo Yasuda.

Identifiers: *Operating variables, *Filter fabrics, *Mathematical analyses, Japan, Aerosols, Diffusion.

A semitheoretical correlation between single fiber efficiencies of fibrous aerosol filters and operating variables such as particle size, fiber diameter, and air velocity is developed. The equations are directed toward interception and diffusion of particles, and are expected to be applicable to clarifying the divergences of data reported in the literature. Such differences may also be attributed in part to the differences in physicochemical properties of both aerosol particles and fibrous beds. In addition, the method indicates the possible existence of mechanisms at work other than the inertial impaction, interception, and diffusion of particles.
APTIC-22394

### AIR CLEANERS: APPLICATIONS AND EFFICIENCY MEASURING METHODS.

Air Cond., Heat., Ventil., vol. 61:55-59, March 1964.
P. E. McNall Jr.
Identifiers: *Filters, Smoking, Sewage treatment, Operating variables, Particle size, Filter fabrics, Haze.

After a brief discussion of some commonly-used types of air filters and their applicable test methods and efficiencies (including impingement type panel filter, two-stage electronic air cleaners, extended media dry filters, very high performance media filters, and grease filters), summaries are given of six papers presented at a symposium on air cleaner application. (1) An evaluation was made of a new instrument for measuring filter efficiency by determining a curve of efficiency-vs.-particle size (fractional efficiency). (2) Experiments on tobacco smoke and haze showed that practical predictions can be made of air cleaner performance on haze contaminants. (3) Tests were reported on equipment for air cleaning applications in sewage plant processes. (4) Characteristics and application of extended media dry filters, in which deep pleats in the media extend the surface, were reviewed. (5) Requirements for specially designed filters to deal with aerosolized grease from food frying were discussed. (6) The microstructure of four common filter materials (cotton fiber paper, in fine glass fiber mat, 1/4 in. nonwoven carded cotton web, and spun glass filter of the throwaway panel type) and its effect on filter applications were reviewed.
APTIC-22395

### NEW BAG FINISH LENGTHENS GAS-FILTER LIFE.

Chem. Eng., vol. 69:92, 94, Nov. 12, 1962.
Personal Author Not Recorded.
Identifiers: *Graphite, *Surface coatings, *Glass fabrics, Costs, Colloids, Temperature.

The results of pilot testing of a fabric finish that reduces fiber-to-fiber abrasion in glass-bag gas filters are reported. The finish is obtained by applying colloidal graphite directly to commercial silicone-treated glass fabric. According to tests, the graphite increases fabric endurance by a factor of three to five at 425 F and below. At 525 F, the advantage is less, but will still be significant if the endurance can be substantiated in plant operation. Cost estimate for a 100,000-cu ft/min baghouse (1.5 ft/min filtration velocity) with 5% by weight colloidal graphite is about $4540. The favorable test results are mainly limited by the possibility that graphite's protection of the fibers is related to some property that varies with time rather than with the number of flexes.
APTIC-22396

### SULFUR THAT GETS AWAY.

Chem. Week, 98 (21):26-28, May 21, 1966.
Personal Author Not Recorded.
Identifiers: *By-product recovery, *Sulfur compounds, Economic losses, Stack gases, Sulfuric acid.

Several processes under development for recovering sulfur now emitted in stack gases are noted; this potential resource is related to a present shortage of sulfur for industrial use in the U. S. and other areas. A major cause of the shortage is the increasing demand due to new foreign and domestic capacity for sulfuric acid and fertilizer. Sulfuric acid producers are hardest hit by the shortage. U. S. governments efforts to discourage rising sulfur prices are outlined. Drilling of offshore sulfur deposits is receiving increasing attention, and a worldwide search for more sulfur from a variety of sources is underway.
APTIC-22397

### IN SITU MEASUREMENT OF THE EFFICIENCY OF ABSOLUTE FILTERS.

Health Phys., 12 (6):861-862, June 1966. 2 refs.
P. Abraham.
Identifiers: *Reactors (nuclear), *Filters, Asia, Particulates, Field tests.

Measurements of the efficiency of filters installed in a reactor exhaust system, made by taking filter paper air samples from upstream and downstream of the absolute filters during normal operation, are briefly noted. Mean efficiency was 99.977% for the Cambridge filter (model IE-1000) tested.
APTIC-22398

### THE AIR FLOW RESISTANCE OF GLASS FIBRE FILTER PAPER.

Can. J. Chem. Eng., vol. 39-41:67-72, April 1963. 14 refs.
J. A. Wheat.
Identifiers: *Glass fabrics, *Flow rates, Canada, Aerosols, Mathematical analyses, Pressure.

The air flow resistance of aerosol filter papers composed of very fine glass fibers and mixtures of these fibers with much larger ones of viscose rayon and Vinyon was measured in the region of streamline flow. Average fiber diameters ranged from 0.18 to 14.4 micron and paper porosities from 0.75 to about 0.94. The resistance across each specimen was measured at a series of flow rates giving pressure drops ranging from about 0.5 to 12 in. of water. Results are included for varying thicknesses and for bonded and ashed papers. At atmospheric pressure, the data were correlated by an equation derived from an expression for the drag force on an individual fiber perpendicular to the direction of flow. The resistance coefficient k varied with fiber diameter according to the empirical relationship 1/k equals a plus b (C - 1) and was about 30 for the largest fiber diameter and 1.6 for the smallest. Two alternative methods are proposed for adapting the equation to pressures below atmospheric. (Author abstract modified)
APTIC-22399

### SOME PROBLEMS IN THE DEODORIZATION OF GAS DISCHARGES IN THE SULFATE-CELLULOSE INDUSTRY.

(Nekotorye voprosy dezodoratsii gazovykh vybrosov sul'fatno-tsellyuloznogo proizvodstva). Tr. Tsellyul. Bum. Prom., vol. 13:148-154, 1964. 10 refs. Translated from Russian. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 13p., Nov. 11, 1969.
V. G. Vedernikov, and V. F. Maksimov.
Identifiers: *Paper manufacturing, *Odor counteraction, Ussr, Stack gases, Odors, Electrostatic precipitators, Scrubbers, Absorption, Black liquor oxidation, Alcohols, Mercaptans, Hydrogen sulfide, Hydrolysis.

The use of uncondensed exhaust gases as a deodorizing agent in the sulfate-cellulose industry is discussed. Mercaptan and hydrogen sulfide trapping methods are described. A sulfane production system which employs condensation, scrubbing, absorption, and a methanol bath is considered. Experiments with black liquor oxidation are conducted in an attempt to solve deodorizing problems. The industrial method of obtaining dimethylsulfoxide from the toxic sulfur-containing discharge dimethylsulfide is discussed. Gases uncondensed by water discharged by the digestion works must be combined and directed into an absorption chamber. On evaporation of black alkalies, H2S and methyl mercaptan are isolated as a consequence of the hydrolysis of sodium sulfide and sodium mercaptide contained in the black alkali. Deodorization in the soda section with an electrofilter and a scrubber is feasible, but requires corrosion resistant conduit.
APTIC-22400

### THE MEASUREMENT OF DUST CONCENTRATIONS IN THE CHIMNEY INPUT GASES AT THE THERMAL POWER STATION OF CREIL (OISE).

For primary bibliographic entry see Field 03.
APTIC-22401

### STACK-GAS SULFUR MAY BE BOON TO FERTILIZERS.

Chem. Eng. News, 45 (40):72, 74, Sept. 18, 1967.
Personal Author Not Recorded.
Identifiers: *Fertilizer manufacturing, *By-product recovery, *So2 removal (combustion products), Stack gases, Electric power production, Sulfuric acid, Ammonium compounds, Sulfates.

The possibilities for sulfur recovered from power plant stack gases to become a major raw material source for the fertilizer industry, now facing short supplies and high prices of sulfur, are briefly discussed. The type and quality of the recovery product - whether as ammonium sulfate, sulfuric acid, sulfur dioxide, or elemental sulfur - will indicate its importance for the industry. High costs of shipping very dilute gases may require location of the fertilizer plant next to the power plant.
APTIC-22441

### A NEW APPROACH TO DESULFURIZATION.

Oil Gas J., 65 (48):74, Nov. 27, 1967.
Personal Author Not Recorded.
Identifiers: *Gasification (synthesis), *Catalysts, Great britain, By-product recovery, Desulfurization of fuels, Hydrogen sulfide.

The potentials of a new 'dry' catalytic process for removing sulfur from fuel, using either an activated alumina or molecular sieve catalyst, are briefly discussed. The process, which would permit recovery of more than 90% of the sulfur present, embodies the gasification of sulfur-bearing fuels by partial combustion with air or oxygen; the sulfur is then converted mainly to hydrogen sulfide which can be removed from the gas stream by catalytic reaction with injected sulfur dioxide. This will leave a combustible low-sulfur gas containing carbon monoxide, hydrogen, carbon dioxide, and water. Possible refinements of the process, which has not yet proved successful on a commercial scale, are noted.
APTIC-22442

### SCRUBBER TWISTS GAS FLOW FOR HIGHER EFFICIENCY.

Chem. Eng., 73 (24):88, Nov. 21, 1966.
Personal Author Not Recorded.
Identifiers: *Scrubbers, *Design criteria, Particle size.

A scrubber design is described which, by directing the polluted gases through a precisely calculated twisting path of perforated plates and deflectors, is able to clean large volumes of gas for its size. The design also allows horizontal installation in limited spaces. Because evaporative losses are low, the unit works well when scrubbing media other than water must be used. Pressure drop is extremely low. In field tests, it has removed particles as small as 0.4 micron from a gas stream.
APTIC-22443

### EMISSION CONTROL FOR GASOLINE-POWERED HEAVY-DUTY VEHICLES.

Preprint, Society of Automotive Engineers, Inc., New York, 9p., 1969. 7 refs. (Presented at the National Combined Fuels and Lubricants and Transportation Meetings, Houston, Tex., Nov. 4-7, 1969, Paper 690763.)
F. D. Griffith.
Identifiers: *Trucks, *Engine design modification, Emission standards, California, Engine exhausts, Gasolines, Internal combustion engines, Engine operation modification.

Development of emission control systems for complete line of heavy-truck gasoline engines is presented. Experience gained in emission control programs for engines used in light-duty vehicles proved beneficial in establishing basic guidelines for heavy-truck program. Various engine modifications, primarily concerned with induction systems and combustion chambers, provides sufficient emission reduction to meet 1969 California and 1970 Federal standards. Secondary air injection into exhaust is not required. Durability tests required for certification indicate the necessity of adhering to recommended service procedures to maintain low emission levels. (Author abstract modified)
APTIC-22449

### GAS CENTRIFUGAL SEPARATION.

Genshiryoku Hatsuden, 4 (3-4):49-61, 1960. 29 refs. Translated from Japanese. Atomic Energy Commission, Oak Ridge, Tenn., Technical Library Research Service, 46p., April 24, 1962.
Akira Kanagawa.
Identifiers: *Centrifugal separators, *Isotopes, Japan, Gas sampling, Design criteria, Uranium compounds, Gases.

The gas centrifugal separation method as a uranium enrichment method separating isotopes is discussed from the standpoint of its historical development, theoretical and technical problems, and its economics as compared with the gas diffusion method. The advantage of the gas centrifugal separation method is that it gives a large separation coefficient, and an excellent thermodynamic efficiency can be expected of it; but many technical problems remained to be solved, such as the material of the rotating cylinder which makes greater peripheral speeds rotation possible, the bearings at high speed rotation, the plant maintenance and cascading in large-scale production.
APTIC-22451

### FROZEN-STORAGE PROJECT FOR LIQUID METHANE GOES AHEAD.

Oil Gas Intern., 4 (1):49-50, Jan. 1964.
C. W. Evelyn Jr.
Identifiers: *Storage facilities, *Methanes, *Compressed gases, Cements, Aluminum, Soils, Design criteria, Freezing, Pressure.

Excavation and tank statistics are related for a 240,000 bbl capacity frozen storage facility for liquid methane, which is being constructed at Arzew, Algeria. Geological suitability of the area for the building was determined from core holes drilled at the site. Construction began with the drilling of three concentric rings of holes in which the casing for the freezers was installed. The freezers are arranged to form a consolidated ice ring with an approximate thickness of 3.5 m at sea-level elevation and 6 m at maximum depth. During the freezing process, which is expected to take about 5 months, the installation of the foundation for the outer cement wall and supports for the roof structure will be made. Excavation operation will be carried out through five 20 by 20-ft openings in the aluminum-alloy-skin flat roof, during which time the freezing plant will be operated to maintain the ice wall as a barrier to the encroachment of the sea and subsurface waters. Pressure and vacuum tests will be performed, and the final fitting out and installation of the submerged-type discharge pumps will then take place. Methods will be taken to reduce the effects of thermal shock and to control the effect of heat influx from the initially unfrozen ground. Freezing will be by circulation of refrigerated calcium chloride brine, while the brine temperature will be controlled within -4 to -13 F. Operating pressure of the earthen tank, roof and seal is the equivalent of a 12-in. water column (positive) to a 2-in. water column (negative).
APTIC-22464

### RESIDENCE TIME OR LOOSE MATERIAL IN CYCLONE-TYPE EQUIPMENT.

(Vremya prebyvaniya sypuchego materiala v apparate tsiklonnogo tipa). Text in Russian. Zh. Prikl. Khim., 42 (5):1081-1084, 1969. 8 refs.
Yu. A. Miklin, P. G. Romankov, and V. F. Frolov.
Identifiers: *Fluid flow, *Settling particles, *Wet cyclones, Ussr, Particle size, Mathematical analyses, Density.

The Navier-Stokes equation for gas flow is used as the theoretical basis for deriving an expression for residence time of loose material in a cyclone flow as a function of Froude number (75-1000), Stokes number (6-100), and relative concentration of the solid material. Numerical coefficients were determined experimentally for relative concentrations of 0.05-1.00 g/g air, air flow rate of 8-33 m/sec, cyclone diameter of 50-150 mm, particle size 0.37-2.4 mm, and density of solid 0.9-2.6 g/cu cm. Coefficients are tabulated for the following test materials: suspension polystyrene, emulsion polypropylene, sodium chloride, quartz sand, and silica gel. Experimental results are within 10% agreement with theory.
APTIC-22470

### EFFECTIVENESS OF COOLING STACK GASES WITH WATER IN A FOUR-STAGE FOAM DEVICE.

(Effectivenost' okhlazhdeniya dymovykh gazov vodoy v chetyrekhstupenchatom pennom apparate). Text in Russian. Teploenergetika, 7 (5):55-60, 1960. 10 refs.
B. A. Chertkov.
Identifiers: *Stack gases, *Bubble towers, *Cooling, Ussr, Heat transfer, Water, Flow rates.

Data on the cooling of stack gases in an experimental foam bubbler are reported. Inlet gas velocity was varied from 2.7 to 1.65 m/sec and the total hydraulic resistance of the bubbler ranged from 67 to 177 mm water. A coefficient of heat transfer of 6000-6500 kcal/cu m-hr-deg C was established and it is estimated that its efficiency per unit volume is 20 times greater than for a packed column.
APTIC-22478

### OXIDES OF NITROGEN FROM SMALLER GASOLINE ENGINE.

Preprint, Society of Automotive Engineers, Inc., New York, 15p., 1970. 12 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 12-16, 1970, Paper 700145.)
Kiyoshi Matsumoto, Tadahide Toda, and Hidetaka Nohira.
Identifiers: *Engine exhausts, *Automotive emission control, *Nitrogen oxides, Japan, Internal combustion engines, Air-fuel ratio, Spark timing, Engine design modification.

The new California regulations governing emission of oxides of nitrogen from automobile exhausts present a special problem to small engine manufacturers, for little of the available data enable them to satisfy the requirements and still produce vehicles that have maximum power output and maximum fuel economy. Essential information for designers is provided and they are alerted to the danger of adverse effects on engine and vehicle performance resulting from the usual corrective measures of rich mixture, retarded spark timing, and exhaust gas recyling. Engine modifications and an effective gas recycling method are suggested to alleviate these undesirable side effects. The influence of engine variables on the concentration of nitric oxide include air/fuel ratio and spark timing, manifold pressure, engine speed, coolant temperature, and compression ratio.
APTIC-22480

### EXHAUST EMISSION CONTROL SYSTEMS AND VAPOR LOCK--CRC ROAD TESTS.

Preprint, Society of Automotive Engineers, Inc., New York, 20p., 1969. 6 refs. (Presented at the National Combined Fuels and Lubricants and Transportation Meetings, Houston, Tex., Nov. 4-7, 1969, Paper 690759.)
J. L. Keller, H. T. Niles, and H. A. Bigley Jr.
Identifiers: *Vapor lock, *Automotive emission control, Engine exhausts, Engine operating cycles, Gasolines, Operating variables, Automobiles, Vapors, Temperature, Volatility.

The results of a series of vapor lock road tests on 26 cars (1966 models), half of which are equipped with exhaust emission control systems are reported. The objectives of the tests are to determine the effect of emission controls on vapor locking tendencies, to study effects of fuel volatility and operating conditions on fuel system temperatures, and to study correlation of these temperatures with temperature versus vapor/liquid ratio characteristics of fuels. The data obtained show no significant difference in vapor locking tendency between the emission control equipped and nonequipped cars as groups, though significant differences are shown for some individual car pairs. An analysis is presented of the relation between fuel volatility, pump temperature during acceleration, and the onset of vapor lock. (Author abstract modified)
APTIC-22481

### EVALUATION OF EXHAUST RECIRCULATION FOR CONTROL OF NITROGEN OXIDES EMISSIONS.

Preprint, Society of Automotive Engineers, New York, 9p., 1970. 3 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 12-16, 1970, Paper 700146.)
W. Glass, F. R. Russell, D. T. Wade, and D. M. Hollabaugh.
Identifiers: *Engine exhausts, *Engine design modification, *Nitric oxide (no), Engine operation modification, Hydrocarbons, Carbon monoxide.

Exhaust gas recirculation is a promising approach to nitric oxide emission control when used in conjunction with either engine modifications or manifold air injection to control hydrocarbons and carbon monoxide. Nitric oxide reductions of about 60% are achieved with minimal debits in fuel consumption, driveability and CO and hydrocarbon emissions. Long-term effects remain to be established. (Author abstract modified)
APTIC-22482

### ABSORBER MATERIALS FOR SO2 FROM FLUE GAS.

In: Metals and Ceramics Division Annual Progress Report for Period Ending June 30, 1969. Oak Ridge National Lab., Tenn., Metals and Ceramics Div., Contract W-7405-eng-26, p. 211, Oct. 1969.
CFSTI: ORNL-4470
W. S. Ernst Jr.
Identifiers: *Absorption (general), *Sodium compounds, *Aluminum oxides, Stack gases, Hydrogen, Carbon dioxide, Hydrogen sulfide, Reaction mechanisms, Crystal structure.

Sulfur dioxide can be removed from flue gases by contacting it with sodium aluminate particles. When saturated, these particles are regenerated in hydrogen, and hydrogen sulfide is driven off. However, in pilot plant tests, the attrition losses of the particles were so high that this process does not appear to be economical. The physical aspects of the reactions that occur when sodium aluminate is sulfatized and desulfatized cyclicly are being studied. The objective is to determine if the

changes in crystal structure limit the usefulness of the sodium aluminate particles. No degradation was found when sodium aluminate was cyclicly exposed to static beds of pure SO2 and then to H2. However, metallographic examination of the starting material revealed large internal cracks in a large fraction of the particles. These cracks probably contribute to the attrition. The particles are hygroscopic and also absorb carbon dioxide. The crystallographic changes and their effects seem unimportant relative to the contribution from the internal cracks and hygroscopic nature of the particles.
APTIC-22483

### CONTROL OF FLUORIDE EMISSIONS.

Vanderbilt Univ., Nashville, Tenn., School of Engineering, Tennessee Stream Pollution Control Board, and Tennessee Dept. of Public Health,
Proc. Conf. Environ. Water Resources Eng., 8th Ann., Nashville, Tenn., 1969, p. 211-228. 21 refs. (June 5-6.)
John P. Jewell, and Burton B. Crocker.
Identifiers: *Control equipment, *Design criteria, *Fluorides, Limestone, Stack gases, Dusts, Operating variables, Centrifugal separators, Electrostatic precipitators, Bag filters, Packed towers, Spray towers, Venturi scrubbers, Absorption.

Fluoride compounds released to the atmosphere may be particulate, gaseous, or a mixture of the two. Solic particulate fluorides are usually released from handling operations which generate dust. Hoods or enclosures to contain or collect the particles and bag filters are desireable recovery devices. There are several methods for controlling gaseous fluorides including injection of ground limestone dust into the gas stream and wet scrubbing. Most installations for controlling gaseous fluoride emissions have involved absorption in water. Packed towers and spray towers are generally used for this purpose. One method of sizing water scrubbers is to obtain an idea of the number of transfer units needed to get from the maximum fluoride concentration in the inlet gas to the desired concentration in the outlet gas. Venturi scrubbers waste power when only gaseous fluorides are to be collected, but they may be the most economical multi-purpose scrubbers when a mixture of gaseous and particulate fluorides must be collected. It is recommended that the effluents be sampled and monitored to determine the operating efficiency of control equipment. Several sampling techniques are discussed.
APTIC-22484

### STATUS OF MOTOR VEHICLE EXHAUST AFTERBURNERS.

Preprint, American Petroleum Inst., New York, Div. of Refining, 4p., 1960. 2 refs. (Presented at the American Petroleum Institute Division of Refining Midyear Meeting, 25th, Detroit, Mich., May 11, 1960.)
W. L. Faith.
Identifiers: *Afterburners, *Automotive emission control, State governments, Emission standards, California, Automotive emissions, Engine exhausts, Operating variables, Catalytic afterburners, Flame afterburners, Hydrocarbons, Carbon monoxide, Combustion, Flow rates, Temperature.

In order to meet California state standards of 275 ppm hydrocarbons and 1.5% carbon monoxide in automobile exhaust emissions, three general types of afterburners are under active development: low-temperature catalytic unit, high-temperature catalytic unit, and the direct-flame afterburner. All three types must handle exhaust gases at widely varying flow rates, temperatures, and combustible concentrations. All three require additional air for combustion, an increase in the energy level of the incoming gases, and a means of combating excessive heat release. Among the technical problems are startup lag time, deposition of lead salts, materials of construction, maintenance requirements, loss of efficiency with time, and effect on vehicle operation. The current status of afterburner development is definitely a fluid one. Some promising prototypes are still being tested with simulated exhaust, on a laboratory bench scale; others are undergoing fleet tests to determine operating characteristics in the field. It appears that the catalytic approach, if perfected, could be the ultimate answer to the exhaust problem, but it probably faces more immediate barriers to success than the direct-flame afterburner. An eventual market for both types can be foreseen. (Author abstract modified)
APTIC-22486

### COMBINING PROTECTIVE AND ORNAMENTAL CHARACTERISTICS OF WOODY PLANTS.

For primary bibliographic entry see Field 14.
APTIC-22488

### MEASURES TO ELIMINATE ATMOSPHERIC POLLUTION FROM 'VTORTSVETMET' MILLS.

In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Effects and Symptoms of Air Pollutes on Vegetation; Resistance and Susceptibility of Different Plant Species in Various Habitats, In Relation to Plant Utilization for Shelter Belts and as Biological Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver Spring, Md., American Institute of Crop Ecology, 1969, p. 24. 1 ref. (Also: Akad. Nauk SSSR. Ural. Filial. Komis. po Okhrane Prirody. Rastitel' nost' i promyshlennye zagrayzneniya. Okhrana prirody na Urale. V (Sverdlovsk), 1966, p. 59.)
I. S. Rozenshteyn, and K. N. Gorbunova.
Identifiers: *Primary metallurgical processing, *Control equipment, *Lead compounds, Plants (botany), Lead, Ussr, Combustion gases, Stack gases, Furnaces, Centrifugal separators, Bag filters, Scrubbers, Oxides.

Areas where lead-babbit shops are located suffer from heavy pollution by lead oxides discharged from the furnaces and the ventilation system. The average daily concentration of lead, in some cases at 200 m, was 0.085 mg/cu m, and at 1000 m, 0.026 mg/cu m. These values are 122 and 38 times higher than the permissible limit for air in settled areas. To reduce the lead discharge and purify the exhaust gases from the furnaces, a scrubber-cooler, compound cyclone, and bag filter complex was installed. Following purification, the gases are discharged through an 80 m stack. After installation, the average daily concentration of lead, in the atmosphere beyond the 500 m sanitation protective zone of green plants, was lowered to 0.00035 mg/cu m. Discharge from the ventilation system of lead-babbit shops should also be purified in bag filters. To protect the population from the injurious effects of industrial discharges, a protective zone belt of green plants should be included in the sanitation plans.
APTIC-22492

### EFFECT OF PLANTINGS OF THE SANITARY AND HYGIENIC CONDITIONS OF DENSELY POPULATED SETTLEMENTS.

For primary bibliographic entry see Field 14.
APTIC-22493

### RECOMMENDED PROCEDURES FOR PLANTING SANITARY-PROTECTIVE GREEN BELTS IN AREAS OF INDUSTRIAL ENTERPRISES.

For primary bibliographic entry see Field 14.
APTIC-22494

### URGENT QUESTIONS CONCERNING VERDANT PLANTINGS IN THE CITY OF BAKU.

For primary bibliographic entry see Field 14.
APTIC-22497

### PROBLEMS IN THE CONSTRUCTION OF HIGH SMOKESTACKS IN THE GERMAN DEMOCRATIC REPUBLIC.

For primary bibliographic entry see Field 14.
APTIC-22500

### CYCLONE SEPARATOR FOR POWER PLANTS.

(Zyklonabscheider fuer Energieanlagen). Text in German. Energietechnik, 17 (12):536-538, Dec. 1967. 7 refs.
Volker Quitter, and Bruno Degner.
Identifiers: *Dusts, *Electric power production, *Centrifugal separators, Germany, Operating variables, Particle size, Maintenance.

Cyclone dust arresters in power plants can process at most 100,000 cu m/h air; their dust separation efficiency decreases with decreasing particle size. If particle size, composition, and dust concentration of the air to be purified are known, then the effectiveness of dust separation and the residual dust pollution in the purified air can be calculated for all types of cyclone dust arresters manufactured on the basis of their past performance. Theoretical calculations are still not quite accurate. In small industries, mechanical dust arresters are cheaper than electrostatic precipitators. The servicing of dust arresters involves the control of dust removal which should be continuous. Discontinuous emtying can lead to clogging in which case the stream of air passes through the equipment without being purified. Pressure must be watched: loss of pressure indicates clogging. Cyclone cylinders must be inspected for tightness: air infiltration through cracks in the wall reduces dust separation efficiency. Defective heat insulation can lead to corrosion or to caking of dust. The dust residue in purified air must be checked regularly the manufacturer's lubrication schedule must be followed, and finally in the case of multiple cyclones equal distribution of the air flow to individual cyclones must be checked regularly.
APTIC-22501

### COMPARISON POSSIBILITIES IN THE OPERATION OF GAS DESULFURIZATION PLANTS WITH SOLID PURIFIER.

(Moeglichkeiten eines Betriebvergleichs von Gasentschwefelungsanlagen mit fester Reinigungsmasse). Text in German. Glueckauf (Essen), 101 (9):568-576, 1965. 2 refs.
Karl-Heinz Koehler.
Identifiers: *Coke oven gas, *Absorption, *Hydrogen sulfide, Germany, Coke, Fuel gases, Operating variables, Scrubbers, By-product recovery.

Gas desulfurization installations with a solid purifying agent are designed to remove hydrogen sulfide from coke-oven gas so that it can be used as consumer gas or for synthesis. The purification substance used for this purpose in the Ruhr area is a mixture of bog iron ore, Martin mass, and wood chips. An analysis of the factors influencing the output of such installations, namely size, technical construction, the sulfur enrichment factor of the purifying agent, and mode of operation disclosed the existence of a correlation between the operating life of a gas desulfurization installation and the specific mass absorption capacity expressed by the quotient of the purifying mass and the daily supplied quantity of sulfur. The number of purification towers thus represented the parameter for comparison. Sulfur enrichment as a function of the specific absorption capacity of the purifying agent manifested a maximum for each number of purification towers. With an increasing number of towers, the maximum shifted in the direction of lower specific absorption capacity. This finding has to be taken into consideration when an addition of a new tower to an existing 3 to 4 tower installation is contemplated.
APTIC-22503

### DUST AND GAS EMISSIONS FROM THERMAL POWER STATIONS.

(Die staub-und gasfoermigen Emissionen von Waermekraftwerken). Text in German.
Brennstoff-Waerme-Kraft, 10 (18):479-486, Oct. 1966. 19 refs.
Rudolf Quack.
Identifiers: *Electric power production, *Control equipment, *Sulfur oxides control, Germany, Dusts, Soot, Fuels, Centrifugal separators, Electrostatic precipitators, Glass fabrics, Fuel oil preparation, Adsorption (general).

The pollution generating components of the various fuels used by thermal power stations are analyzed and the pollution control methods available are reviewed. The dust content in flue gases from solid fuel furnaces is from 0.5 to 15 g/cu m. In small and medium large grate firings which generate dust with 50% of the particles larger than 10 micron mechanical centrifugal separators are the rule. Siliconized glass fiber filters are too costly for large steam generators but can be used in smaller installations. Large installations, to comply with the pollution control requirements set by the West German laws, are compelled to use electrostatic precipitators. Liquid fuel furnaces use mostly heavy heating oil which with an ash content of only 0.01 to 0.05% emit dust only through soot formation by the flame or from additives. Crushing and transport installations for solid fuels and for combustion residues can also emit dust. Of the gases emitted from solid fuels, sulfur dioxide from the oxidation of sulfides can be removed by dry adsorption on semicoke or the coal can be converted to gas and the gas desulfurized. Desulfurization of heavy fuel oils is accomplished through hydration which converts the sulfur to hydrogen sulfide. Desulfurization should be done centrally in large plants rather than by each power station separately. While the production of electricity in West Germany increased fourfold from 1950 to 1963, the dust pollution from power stations has been reduced by one third. Further reduction of the pollution level with present means would be financially prohibitive.
APTIC-22505

### THE SPIRAL FLOW TECHNIQUE AND ITS APPLICATION IN DUST REMOVAL, SIFTING, AND DRYING.

(Drehstroemungstechnik und ihre Anwendung zur Entstaubung, Sichtung und Trocknung). Text in German. Chem. Anlagen Verfhren, no.1-2:37-40, Jan.-Feb. 1968. 11 refs.
Heinrich Klein.
Identifiers: *Dusts, *Exhaust systems, *Drying, Germany, Measurement methods, Particle size, Settling chambers, Fractionation, Fractionation.

The spiral flow technique can be used to advantage to dry particles which float in a stream of hot air. By regulating the air supply, rotating dust rings or coils can be produced and kept floating and rotating for any desired length of time in a cylindrical dryer. The rotating dust rings or coils move upward by a manipulation of air supply until they reach the top of the dryer. Entering wet dust particles are thus thoroughly dried or calcined as the case may be and settle outside the dryer so that the equipment can be readily switched over to a different material. Drying time and temperature can be regulated with precision which is of great importance in some cases (plastics). In order to predict with exactitude the performance of such industrial dryers, a portable miniature version has been designed and built to serve as a measuring instrument. Sample quantities of the polluted gas to be purified on an industrial scale are purified by the measuring device and the filtering effect is calculated from the quantity of dust captured by the device and the residue captured by a paper or fabric filter connected to the exhaust end of the measuring device. This device can also be used to determine grain size distribution of atmospheric particles by fractionation.
APTIC-22506

### WET DUST-ARRESTERS IN THE U.S.S.R.

(Nassabscheider in der Sowjet-union). Text in German. Wasser Luft Betrieb, 12 (6):374-375, 1968.
Peter Lutsch.
Identifiers: *User, *Control equipment, *Dusts, Germany, Aerosols, Centrifugal separators, Screen filters, Design criteria.

Four wet dust-arrester models in use in the U.S.S.R. are described. In the first designed especially for the removal of aerosols and of acid vapors from air, the air to be purified is drawn by suction through a water bath where the air current is sprayed by water which is accomplished by means of a screen. The sludge is collected in a chamber where it is separated by a filter. For proper operation, the screen must be immersed in the water to a certain depth. In a second model, the air similarly passes a water bath through suction in a chamber which is screened off by a separator filled with solf aluminum shavings which separates the solid phase and is self-cleaning through the constant action of dripping water. In a third spherical model, separation is achieved by means of a rotating horizontal cylindrical filter which reaches into a water bath. The air to be purified is led by suction into the inside of the filter drum where the solid phase is filtered out and then continuously washed out in the bath. A fourth model separates the solid phase by means of a centrifuge. The mixture of the solid and liquid phase is drawn by suction into the rotor of the centrifuge where the solid phase is deposited on the rotor walls by centrifugal force. A worm drive continuously removes the sediment from the rotor wall into the stator from where it is removed.
APTIC-22507

### A THERMALLY RESISTANT PROTECTIVE FINISH FOR GLASS FIBER FILTERS.

Preprint, American Institute of Chemical Engineers, New York, N. Y., 16p., 1962. 1 ref. (Presented at the American Institute of Chemical Engineers, Annual Meeting, Chicago, Ill., Dec. 2-6, 1962.)
Paul W Spaite, John E. Hagan, and William F. Todd.
Identifiers: *Surface coatings, *Glass fabrics, Graphite, Temperature.

Commercial glass-fiber fabrics all employ silicone treatments for protection against abrasion and flex failures, but the service life of such finishes at temperatures between 350 and 550 F is not well defined. A protective finish that would extend fabric life in this temperature range or permit the use of glass fabrics at higher temperatures would extend the usefulness of such fabrics as a means for high-efficiency removal of particulates in many industries. The main source of differences in the severity of wear imposed at different temperature levels was differences in the intensity of the flex. Intensity of the flex was a function of the amount of slack present when the filter was tested, and the amount of slack changed during exposure of the filter to test conditions. This change or distortion was a function of the temperature and pressure differential across the filter. Endurance decreases with temperatures up to 600 F, and the observed increase in endurance going to 725 F is probably attributable to increased plasticity of the glass fibers at temperatures over 700 F. Graphite finish increases fabric endurance by a factor of 3 to 5 at 425 F, the advantage is less but still significant at 525 F, and at 725 F the graphite finish was lost from the fabric in all flex areas. Application of the finish and cost estimates are provided, as well as limitations of the data.
APTIC-22514

### PROPOSED INDUSTRY STANDARD FOR ELECTRIC POWER SUPPLIES USED WITH INDUSTRIAL GAS PROCESSING PRECIPITATORS.

For primary bibliographic entry see Field 11.
APTIC-22552

### TESTS ON FLUIDIZED COMBUSTION PILOT PLANT FOR OCR.

Bureau of Mines, Pittsburgh, Pa., Coal Research Center, 11p., June 22, 1966.
A. A. Orning.
Identifiers: *Operating variables, *Ocr processes, Fly ash, Pilot plants, Nitrogen oxides, Decomposition, Oxidation, Combustion, Thermodynamics, Temperature.

Tests were conducted to determine the performance of a small pilot plant for combustion of coal in a fluidized bed, particularly in relation to emission of oxides of sulfur and nitrogen. There was no obvious correlation between the carbon loss and either bed temperature or ash recirculation. Both the oxides of nitrogen decomposition and the sulfur dioxide oxidations were influenced catalytically by the fly ash, and tended to approach an equilibrium value determined by the temperature level at which these reactions were quenched in the final cooling process. Since combustion is not completed in the fluidized bed, both apparent equilibium temperatures were higher than the temperatures measured in the fluidized bed. Low retention of sulfur in refuse materials, rather than in the gas except when dolomite was used, may be a result of the fact that these materials had to pass through the higher temperature zone over the bed.
APTIC-22558

### IMPACT OF AIR POLLUTION REGULATIONS ON FUEL SELECTION FOR FEDERAL FACILITIES.

For primary bibliographic entry see Field 01.
APTIC-22559

### THE ELECTRICAL DE-DUSTING EXPERIMENTAL INSTALLATION OF THE CHATOU TEST AND RESEARCH CENTER.

(L'installation experimentale de depoussierage electrique du centre de recherches et d'essais de Chatou). Bull. Centre Rech. Essais, Chatou (France), no. 18:63-72, 1966. 10 refs. Translated from French. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 15p., Oct. 29, 1969.
R. Aurielle.
Identifiers: *Electrostatic precipitators, *Design criteria, *Experimental equipment, France, Dusts, Smokes, Electric power production, Collectors, Ions, Corona, Electric charge.

A prototype electrostatic precipitator for thermal power-station smoke has two electric fields in a series, each constituting an electro-filter with collecting and emitting electrodes. The collecting electrodes are plates connected to the positive pole; the emitting electrodes are wires connected to the negative pole. The d-c potential difference between the plates and wires ionizes the air around the wires by corona effect. During their passage between the electrodes, dust particles are electrically charged by the ions or by molecular diffusion according to their size. The charged particles are attracted by the oppositely charged collecting surfaces on which they come to rest. The electrodes are hammered or vibrated to free them of deposited dust, which falls by gravity into receiving hoppers. The efficiency of the filter, defined as the ratio of the weight of captured dust to the weight of dust entering the device, depends on the electrode hammering and on the erosion of the deposited dust layer. To determine efficiency, soot deposits are weighed and, to find the mass of unretained soot, the concentration is measured at a point upstream of the electro-filter. Preliminary tests of the filters are in progress at a special experimental center.
APTIC-22560

### DEVELOPMENT OF A PRACTICAL AND ECONOMICAL PROCESS FOR REMOVING THE ALUMINUM CHLORIDE SMOKE

### NUISANCE DURING THE CHLORINATION OF ALUMINUM ALLOYS.

Smoke Prevention Assoc. of America, New York,
Proc. Smoke Prevent. Assoc. Am. 40th, 1947, p.
39-42.
Julius J. Donoso.
Identifiers: *Aluminum compounds, *Chlorides, *Control methods, *Smokes, Aluminum, Stack gases, Primary metallurgical processing, Pilot plants, Glass fabrics, Scrubbers, Chlorine compounds, Vapors, Steam.

Chlorination of molten aluminum alloys for the removal of elements such as magnesium results in the formation of aluminum chloride vapor which, when exhausted to the atmosphere and hydrolyzed, creates dense and voluminous smoke. The smoke nuisance is not abated by tall stacks. However, a steam injection process for treating the vapor has been developed and successfully tested in a pilot plant. By introducing the steam into the furnace effluent gas, the aluminum chloride vapor is converted to stable aluminum hydroxide, which decomposes at 600 F into aluminum oxide and water. The solid and stable aluminum oxide particles are readily precipitated in a Cottrell treater. The corrosive hyperchloric acid formed by the reaction of aluminum chloride and water vapor is recovered by passing furnace gases through a scrubbing tower and fiberglass filter before exhausting them to the atmosphere. At the pilot plant, the effluent visible gas has consisted of condensed steam that is rapidly absorbed in the atmosphere.
APTIC-22566

### DUST COLLECTING.

Zh. Vses. Khim. Obshchestva im. D. I.
Mendeleeva, 14 (4):432-437, 1969. 8 refs.
Translated from Russian. Foreign Technology
Div. Wright-Patterson AFB, Ohio, Translation
Div., 16p., March 11, 1970. CFST, DDC: AD
706206
V. N. Uzhov.
Identifiers: *Dusts, *Control equipment, Costs, Ussr, Particle size, Centrifugal separators, Electrostatic precipitators, Filters, Scrubbers.

A brief review is presented of the nature and size of particles to be removed from industrial gases and of the efficiency of dust collectors. The latter can be divided into four groups: dry or mechanical collectors; wet dust collectors; filters; and electrofilters. Dust collectors of the first group are useful for purifying gases with relatively large particles. Among the most widely used dry collectors are cyclones and battery cyclones. Wet dust collectors are generally more effective than mechanical collectors, but they are usually used only when the dust is waste material or can be readily utilized in a wet form. Dust collectors of the third group comprise fibrous filters, air filters, tissue filters, and granular filters. The advantages or disadvantages of each category are noted. Electrofilters have a high efficiency for the finest particles. Development work on these collectors is concentrating on their automation and increased reliability. Where purification requirements are stringent, electrofilters are sometimes used in conjunction with cyclones. Other dust collecting systems combine hollow scrubbers and turbulent washers or scrubbers and bag filters. Included with the articles is a table of the technical and economic indices of dust collectors used in the Soviet Union.
APTIC-22569

### THE TRANSCONTINENTAL GAS PIPE LINE CORPORATION LIQUEFIED NATURAL GAS PROJECT FOR PEAK LOAD SHAVING SERVICE TO CUSTOMER COMPANIES (LNG SYMPOSIUM).

American Gas Association, Inc., New York, Proc.
Am. Gas Assoc. Operating Section Conf., 1965, p.
190-196.
Harold E. Vaughan.
Identifiers: *Natural gas, *Compressed gases, Costs, Soils, Design criteria, Carbon dioxide, Hydrogen sulfide, Compression.

A plant is being placed into operation with a storage capacity of 1 billion cu ft of natural gas in liquid form at -259 F, and with a delivery capacity of volumes up to 200,000,000 cu ft per day when needed by its customer companies. Located in the Hackensack Meadows of New Jersey, the plant for peak load shaving is adjacent to Transco's main pipeline system and as near its terminal points as a suitable plant site could be located. Soil conditions and the high water table at this location had discouraged industrial development through the years, but pile foundations and a large amount of fill material will increase the elevation of the plant site. Transco's entire pipeline system from the Gulf Coast areas of Texas and Louisiana to the New York Metropolitan area is shown. A simplified flow diagram of the LNG storage facility has five major functioning sections: gas compression, gas purification, gas liquefaction, LNG storage, LNG vaporization and sendout. A total of 11,468,000 cu ft per day of pipeline gas at a minimum pressure of 315 psia is taken out of Transco's main pipeline system, measured, and compressed to approximately 660 psia. After compression, the gas flows through an amine process for removal of carbon dioxide and hydrogen sulfide, and then a dry bed-type dehydration unit for removal of the water content to a satisfactory level. The gas is then liquefied in a cascade system, using propane and ethylene refrigerants and autorefrigeration. Vaporization equipment is designed to heat the gas to a minimum of 50 F. The inground storage container is depicted in profile with construction data mentioned. A proposed rate schedule is on file with the FPC which provides for a three-part rate, consisting of a demand, a capacity and a delivery charge.
APTIC-22576

### CONSTRUCTION AND OPERATION OF FIRST MIDWESTERN LNG PEAK SHAVING PLANT (LNG SYMPOSIUM).

American Gas Association, Inc., New York, Proc.
Am. Gas Assoc. Operating Section Conf., 1965, p.
197-203.
Carl C. Hanke, and Gerald E. Engdahl.
Identifiers: *Natural gas, *Compression, *Compressed gases, Construction materials, Aluminum, Steel, Design criteria, Carbon dioxide.

A double-walled, flat-bottom storage tank is the most important component of the Wisconsin Natural Gas Company's proposed liquefaction facility for peak shaving purposes. The inner tank built of aluminum alloy 5083 has a net liquid capacity of 72,000 bbl. Tapered design provides significant economies in metal and welding. The outer tank is of carbon steel. Automatically controlled electric heating coils beneath the tank bottom control heat migration, while the insulation space surrounding the shell of the inner is 5 ft thick and will be filled with loose-fill expanded perlite. A nitrogen atmosphere will be maintained in the insulation space by means of a vapor breathing system. X-rays and other techniques to check the welding are discussed. The gas to be liquefied can contain as much as 10% nitrogen and 1/2% CO2. Compositions of typical natural gas feeds are presented tabularly, along with feed gas composition used as the design basis for the plant. Molecular sieve beds remove amounts of carbon dioxide and water. Propane and ethylene are the refrigerants used in the cascade cycle, while the fifth level of heat rejection is obtained in one recycled methane loop. The compressors will be housed in the compressor building and all other liquefaction components are being shop assembled on skids. The plant sendout system is designed to pump, vaporize, superheat, and odorize liquid from the storage tank at a rate of 25 MMcf of equivalent gas per day. Indication of important variables, such as pressures and levels, is provided at a central control board; visual and audio alarms indicate process trouble, and certain malfunctions will safely shut down the plant. An aspect of the Racine plant is its ability to be shut down for extended periods and return to service rapidly.
APTIC-22577

### CONSTRUCTION AND OPERATION OF A NEW LIQUEFIED NATURAL GAS PLANT (LNG SYMPOSIUM).

American Gas Association, Inc., New York, Proc.
Am. Gas Assoc. Operating Section Conf., 1965, p.
188-189.
J. A. Pryor.
Identifiers: *Storage facilities, *Natural gas, *Compressed gases, Construction materials, Steel, Nickel, Design criteria, Compression.

A facility being erected in Jefferson County near Birmingham, Alabama, will liquefy and store natural gas during the warm months of the year and vaporize it during peak demand periods. Design liquefaction and reliquefaction rates are predicated on the eventual installation of 300,000 bbl of storage. Pretreatment of the feed gas includes acid gas removal, dehydration, and heavy-hydrocarbon removal. Most of the equipment in the refrigeration system used to cool and condense the natural gas is contained in a shop-fabricated cold box, approximately 10 by 11 ft in cross section by 55 ft 6 in high, which is installed on a concrete foundation at the site. A storage tank to contain 175,000 bbl of liquefied natural gas will incorporate a flat-bottomed, aboveground vessel of 9% nickel construction, which is being provided with perlite insulation contained in a carbon steel outer tank. An automatic venting system is provided to prevent tank pressurization in the event of malfunction of the compressor or control system. Provisions have been made to measure temperatures at various points in the tank to observe the possibility of bumping developing, as well as provisions for recirculating liquid withdrawn from various points in the tank to stop bumping from occurring. An elliptically shaped earthen dike is provided around the storage tank and sized to contain 100% of the tank capacity. The sendout system for the facility was designed to withdraw 85 MMscfd of LNG from the storage tank and pump the liquid through vaporizers at 600 psig. Miscellaneous auxiliary equipment includes a cooling water system with circulating pumps and a cooling tower, an instrument air compressor, steam boiler, and emergency power generator. The fire protection system consists of one electric and one diesel fire pump.
APTIC-22578

### AIR.

In: Managing the Natural Environment. A
Regional Plan for Water, Sewage, Air and Refuse.
p. 21-28, March 1970. CFSTI: PB-190290
Personal Author Not Recorded.
Identifiers: *Abatement, Costs, Regional governments, Planning and zoning, Connecticut, New jersey, New york state, Gasolines, Petroleum refining, Electric power production, Incineration, Open burning, Vehicles, Monitoring, Automotive emission control, Engine design modification, Sulfur oxides control, Desulfurization of fuels, Nitrogen oxides.

Control of air pollution is discussed for the Tri-State Region of Connecticut, New Jersey, and New York. Possible actions available for public consideration are to require control of vehicular emissions, prohibit gasoline-powered vehicles selectively or everywhere, prohibit the use of high-sulfur fuels or regulate the amount of sulfur compounds that may be emitted from smokestacks, control incinerator emissions, ban all open burning, establish acceptable limits of pollutants in the air, and monitor pollution and establish alerts. Major oil companies are establishing desulfurization plants, and are developing fuel additives to counteract sulfur content. New vehicles are now equipped with modified engines that provide more thorough combustion or devices to control exhaust. One important group of pollutants that is still not controlled is nitrogen oxides, which come from autos, space heaters, and power plants. Future land development may help to reduce the worst concentrations of air pollution. There is also a strong tendency for employment to decentralize, so that factories and commercial buildings will tend to be relatively more dispersed. The yearly

cost per person of air pollution control in the Region is estimated at $9.25 - a little less than it now costs for sewerage service. Extension of comprehensive air-pollution monitoring is recommended to determine whether control programs are succeeding.
APTIC-22580

### DUST DEPOSITION FROM CHIMNEY STACKS.

For primary bibliographic entry see Field 05.
APTIC-22584

### DECOMPOSITION OF CARBONATES.

For primary bibliographic entry see Field 06.
APTIC-22586

### RECLAIMABLE FIBROUS PREFILTRATION MATERIAL.

(Regenerationsfaehiges faseriges
Vorfiltermaterial). Text in German. Czechoslovak
Acad. of Sciences, Prague, Proc. Nat. Conf.
Aerosols, 1st, Liblice, Oct. 8-13, 1962, p. 681-691.
J. Albrecht.
Identifiers: *Plastics, *Treated fabrics, Czechoslovakia, Filters.

The production and testing of a reclaimable prefiltration material 'Nefi' developed by the Institute for Aerodynamic Research in Prague, Czechoslovakia is described which meets the requirements of good particle retention, great storing capacity, easy reclaimability, low cost, complete homogeneity and which can be produced in industrial quantities. Synthetic polyvinylchloride fibers are fed into a carding machine which forms the fibers into a homogeneous cobweb-like fleece. A conveyor feeds the fleece into the Nefi machine where it is spread over a 12 m long and 1.6 m wide carrier and rinsed with a watery emulsion of polyvinylacetate which glues the fibers together at their contact points. The fiber layer is then dried at 100 C and compressed by rollers. The degree of compression of the thermoplastic material is regulated by temperature. The finished product is wound on a reel, the operation is automatic and the desired thickness, compression etc, can be preset. The material comes in 3 types which differ in fiber diameter and weight per unit area. Tested with potassium bichromate solid particle aerosol, its particle retention capacity was 2 to 5 times that of 20 layers of fine-mesh wire netting. Regeneration is accomplished by rinsing with water.
APTIC-22590

### FLUORIDE EMISSION FROM FERTILISER PRODUCTION.

Chem. Engr. (London), 46 (7):CE268, Sept. 1968.
K. Karbe.
Identifiers: *Fertilizer manufacturing, *Control methods, *Fluorides, Stack gases, Scrubbers, Absorption, By-product recovery, Hydrofluoric acid, Calcium compounds, Phosphates.

In general, the crude phosphates that are used as starting materials for the production of fertilizers and phosphates contain 3-4% fluorine compounds. In the preparation of the fertilizers and phosphoric acid, the natural phosphates are decomposed by treatment with acids or by thermal decomposition processes. All methods of decomposition produce fluorine compounds as air contaminants, the thermal processes emitting the compounds as both gases and particulate aerosols. Dry and wet methods are available for purifying exhaust gases from fertilizer production. In the dry methods, hydrogen fluoride is absorbed by chalk or limestone with formation of calcium fluoride. Efficiency is 95%. In the wet methods, the gases are washed with water to convert hydrogen fluoride and silicon tetrafluoride to hydrofluoric and hydrofluosilicic acids, respectively. Removal efficiency of the wet methods is generally better than 90% and can be greater than 98%. Difficulties arise due to the conversion of silicon tetrafluoride to silicon dioxide, which can cause plant blockage. In Germany, exhaust gas emissions from new fertilizer plants cannot exceed 50 mg Fl/cu m.
APTIC-22598

### AUTOMOBILES AND AIR POLLUTION.

For primary bibliographic entry see Field 01.
APTIC-22599

### DUST REMOVAL IN CENTRAL HEATING PLANTS.

(Rauchgasentstaubung in
Zentralheizungsanlagen). Text in German. Wasser
Luft Betrieb, 12 (1):11-13, Jan. 1968.
Herbert Muermann.
Identifiers: *Dusts, *Domestic heating, *Centrifugal separators, Germany, Fuel oils, Operating variables, Design criteria.

Guidance is offered in the selection of a cyclone separator for use in dust removal in a heating plant fired with fuel oil. A smaller diameter of cyclone gives a higher yield of separated dust but increases the risk of clogging the machinery, which leads to breakdowns and to stoppage of production. A new type of dust separating unit is available commercially, with components of 2 sizes. A smaller component contains two cyclones and has a stated output of 1600 cubic meters per hour. The larger unit contains 4 cyclones and has twice the output. Dust removal plants can be built for a given situation by a suitable combination of the right number of components. A description is given of the structure. Larger plants can be equipped with a pneumatic dust transporter.
APTIC-22602

### IMPROVEMENT OF BOILER OPERATION BY MEANS OF FUEL ADDITIVES.

(Besserer Kesselbetrieb durch Wirkstoffe im
Heizoel). Text in German. Erdoel Kohle
(Hamburg), 21 (9):558-561, Sept. 1968. 12 refs.
Otto Meier-Hedde.
Identifiers: *Boilers, *Fuel additives, Corrosion, Germany, Fuel oils, Vanadium compounds, Sulfur dioxide, Sulfur trioxide, Sulfur compounds.

The liquid additive Bycosin was added, usually before filling, to fuel oil tanks at the rate of 1:2500 - 1:5000 and carefully mixed. This not only resulted in improved efficiency of boiler operation but also eliminated molten ash and acid soot flakes, while substantially reducing corrosion, at both high and low temperatures. The effect of the additive on the behavior of sulfur and vanadium compounds in the fuel is discussed.
APTIC-22603

### THE KATASULF PROCESS.

(Das Katasulf-Verfahren). Text in German.
Glueckauf (Essen), 73 (40):901-913, Oct. 2, 1937.
20 refs. (Presented to the 7th Technical
Conference of the Association of Mining Interests
in Essen, May 26, 1937.)
H. Baehr.
Identifiers: *Katasulf process, *Ammonium compounds, Germany, Combustion gases, Coke, Primary metallurgical processing, By-product recovery, So2 removal (combustion products), Ammonia, Sulfur compounds, Sulfates, Sulfides, Hydrogen sulfide, Sulfites, Catalysts.

German economic policies in 1937 called for all possible elimination of imported raw material in the metallurgical industries and the use of processes most advantageous to the application of domestic sources. Specifically, this involved the recovery of ammonia from coke oven gas with the aid of gaseous sulfur compounds. The Katasulf process involves the conversion of hydrogen sulfide to sulfur dioxide by means of a catalyst, and the recovery of this gas and ammonia in the form of ammonium sulfite, ammonium bisulfite, or ammonium thiosulfate by a wet recovery process. At the same time, cyanide is hydrated and unsaturated benzol hydrocarbons are stabilized. The ammonium sulfite liquor is heated in an acid solution in the presence of sulfur, obtaining ammonium sulfate and elemental sulfur. The historical development of the Katasulf process is described, from its experimental laboratory stages to the construction of a large plant capable of handling 32,000 cubic meters per hour. A comparison is made with the Saettiger process, in which it is seen that the Katasulf process is capable of providing products for use in power plants, factories, and commercial uses that is just as economical, in some cases more so. The Katasulf process has the advantage that the contact process enables one to obtain an ammonium sulfite liquor and that the liquor can quite independently replace the ammonium sulfate or other fertilizer salts and sulfur used in central or portable plants. In a general application of this process in the Ruhr region, the annual production for 1929 was 300,000-400,000 tons of sulfuric acid and an additional 25,000 tons of elemental sulfur, all recovered from sulfur-bearing gases and without any increase in production costs.
APTIC-22606

### REACTION KINETICS OF DOLOMITES AND LIMESTONES FROM AMERICAN DEPOSITS WITH SULFUR DIOXIDE.

(Reaktionsverhalten von Dolomiten und
Kalksteinen aus amerikanischen Vorkommen
gegenueber SO2). Bergbau - Forschung G.m.b.H.,
Essen Kray (West Germany), Abteilung
Physikalische Chemie und Verfahrenstechnik,
Rept. 48, 18p. May 23, 1969. Translated from
German. Franklin Inst. Research Labs.,
Philadelphia, Pa. Science Info. Services, 10p., Oct.
16, 1969.
Van Heek, and W. Schmitz.
Identifiers: *Alkaline additives, *Reaction kinetics, Limestone, Germany, Stack gases, Carbonates, Hydroxides, Calcium compounds, Oxides, Temperature.

Since a familiar method of flue-gas desulfurization utilizes metal oxides, primarily calcium oxide, the reactivity of various dolomites and limestone with sulfur dioxide was studied in a differential reactor. Special attention was given to temperature dependence and the total quantity of SO2 adsorbed. Calcination was also included in the measurements since desulfurization with carbonates is a two-step process involving the formation of oxides followed by the binding of SO2. The results are presented in the form of computer-plotted diagrams which indicate the various reaction rates as functions of the sample temperature. The diagrams show that the products tested differ in their capacity to adsorb SO2. On the whole, the bound SO2 volumes are below the capacity of hydroxides and above that of other oxides tested under similar conditions.
APTIC-22617

### SAMPLING DUST-LADEN GASES.

Staub (English translation from German of: Staub, Reinhaltung Luft), 29 (9):32-35, Sept. 1969. 9 refs.
CFSTI: TT 69-55002/9
Kurt Buick.
Identifiers: *Dusts, *Gas sampling, *Samplers, *Control equipment, *Design criteria, Germany, Baffles, Centrifugal separators, Filters.

Two gas samplers for continuous sampling of gas containing a large amount of dust solve the problem of dust removal. The simpler of the two for concentrations up to 30 g/cu m consists of a tube in which a fixed swirl baffle is fitted for generating a rotational flow. Behind the baffle the dust is removed to the outside by centrifugal forces in the turbulence chamber. This generates a zone of low dust concentration along the axis of the tube from which the test gas can be withdrawn. A ceramic filter is mounted in a widened section of the tube to remove residual dust from the gas. The residual gas is aspirated with the dust by a blower

and led to a flue gas duct in a path that permits heating of the gas sampling tube to prevent fluid blockage of the ceramic filter. Efficiencies of 99.5% were attained in the laboratory and in industrial tests. An instrument for dust concentrations in excess of 30 g/cu m was constructed, using the principle of the rotary flow dust collector. The gas is aspirated through the inlet pipe and reaches the primary separation zone by a swirl baffle which generates a rotational flow. The dust is discharged by radial acceleration and reaches the region of secondary air. This secondary air leads the dust via a discharge outlet to the flue gas duct. The gas leaves the primary separation zone and reaches the secondary zone where the flow is still turbulent and the residual dust tends to concentrate in the outer flow zone. Thus, the test gas can be withdrawn from the core of the flow where the lowest concentration prevails. Efficiencies of 99.9% were obtained with this instrument.
APTIC-22618

### PLANTINGS AS DUST FILTERS.

(Die staubfilternde Rolle von Anpflanzungen).
Les. Khoz., vol. 20:39-40, 1967. Translated from German. Belov and Associates, Denver, Colo., 7p., June 1, 1970.
N. W. Podgorow.
Identifiers: *Leaves, *Filters, Trees, Ussr, Dusts, Winds.

The needles of pine trees and the leaves of birch and aspen trees were studied to determine their effectiveness as dust filters. Leaves of identical appearance retain dust differently depending on their specific location. Leaves from inside the crown were covered with more dust than the leaves from the periphery of the crown. The ability of pine needles to act as dust filters is also a function of their age. Three-year old needles located inside the crown detain more dust than needles from the outside after one year. The morphological structure of the leaves also influences their dust-retaining ability. The pores of pine needles form depressions resulting in an uneven surface which retains dust. Birch and aspen leaves, however, are sufficiently mobile so that the wind can remove the deposited dust. Plantings growing in the vicinity of the city of Leningrad retain 80.1% of the precipitation/surface of ground dust. From this quantity, up to 40.2% can be attributed to pine needles. The investigations thus showed that the pine is a good retainer of dust, and should be included in the plantings of parks and wooded areas near an industrial center.
APTIC-22620

### PRODUCTION OF SULFUR FROM HYDROGEN SULFIDE AND SULFUR DIOXIDE.

(American Smelting and Refining Co., New York)
Brit. Pat. 744,908. 9p., Feb. 15, 1956. 4 refs. (Appl. March 9, 1953, 4 claims).
Personal Author Not Recorded.
Identifiers: *So2 removal (combustion products), *Hydrogen sulfide, *Reduction, United states, Petroleum production, By-product recovery, Catalysts, Combustion, Temperature.

The production of elemental sulfur from hydrogen sulfide and sulfur dioxide is described. A gas stream of $H_2S$ and $SO_2$, in the ratio of 2:1, is passed through a catalytic reaction chamber. The reaction conditions are such that the deposition of elemental sulfur on the catalyst is avoided and the sulfur is recovered from the gaseous reaction products. Unreacted $H_2S$ and $SO_2$, from which the elemental sulfur has been separated, are passed to a combustion zone and burned with an oxygen-containing gas to convert the $H_2S$ to $SO_2$. Combustion products are separated into a tail gas, which may be discarded, and an $SO_2$-containing gas. The $SO_2$ gas is recycled to the first gas stream, and thus essentially all of the sulfur values are recovered as elemental sulfur. The gas stream passing to the reaction chamber is preheated to temperatures up to 335 C by indirect heat exchange with the hot reaction products from the chamber. This invention is particularly useful in connection with the sulfurous gases produced in petroleum refining, for which the procedure is outlined.
APTIC-22623

### ANALYSES AND DIGITAL SIMULATION OF CARBURETOR METERING.

Preprint, Society of Automotive Engineers, Inc., New York, 35p., 1970. 25 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 12-16, 1970, Paper 700082.)
D. L. Harrington, and J. A. Bolt.
Identifiers: *Carburetion, *Computer programs, Operating variables, Automobiles, Design criteria, Mathematical modeling, Flow rates, Thermodynamics.

A comprehensive analysis of carburetor metering, employing the fundamentals of fluid mechanics, thermodynamics, and numerical analysis to develop a simulation program is reported. This includes the interactions between individual systems as well as the relationships of the fuel, ambient air, engine, and vehicle variables to carburetor metering. Mathematical models for the individual systems of an air-bled, double-venturi carburetor are are established, and a logical iteration procedure is developed to solve the resulting simultaneous relationships utilizing a digital computer. Basic data on air-bleed flow rates, pressure losses for two-phase flow, and fuel-property effects are presented and discussed. Applications of the simulation are illustrated, and experimental data from both on-engine carburetor tests and fuel-channel model tests are utilized to evaluate the predictions.
APTIC-22666

### DEVELOPMENT OF A RADIOACTIVE AEROSOL FOR TESTING FILTER FABRICS.

Brit. Chem. Eng., vol. 6:12-15, Jan. 1961. 8 refs.
J. K. Skrebowski, and B. W. Sutton.
Identifiers: *Aerosols, *Filter fabrics, *Radioactive tracers, Great britain, Particle size.

A radioactive aerosol is used for measuring the efficiency of dry filter media. The aerosol particles labelled with radioactive phosphorus are size analysed, and their mass median size is 0.3 micron, with no particles greater than 1.2 micron. The technique used for measuring the efficiencies is described; it is easy and safe, and the reproducibility is good. The technique is applicable to numerous problems in the field of dust filtration, both in the laboratory and on the plant. (Author abstract modified)
APTIC-22667

### MODEL FOR PREDICTING PRESSURE DROP AND FILTRATION EFFICIENCY IN FIBROUS MEDIA.

Environ. Sci. Technol., 2 (4): 279-287, April 1968. 35 refs.
Lloyd Spielman, and Simon L. Goren.
Identifiers: *Filter fabrics, *Mathematical modeling, *Pressure, Particulates, Fluid flow.

The importance of fibrous filters in the removal of particulate matter from fluids is well known. For low speed Newtonian flow through fibrous filters, the pressure drop follows Darcy's law in being proportional to the fluid viscosity, the superficial velocity, and the filter thickness. Brinkman's model for flow through unconsolidated porous media is applied to flow through fibrous media to predict pressure drop for several different internal arrangements of the fibers. The essence of the model is that, on the average, the fluid in proximity to an obstacle embedded in a porous medium experiences, in addition to the usual force terms, a body damping force proportional to the local velocity accounting for the influence of neighboring objects on the flow. Implications of the model for correlating pressure drop and filtration efficiency are given. (Author abstract)
APTIC-22668

### REMOVAL OF A MIST IN A FLUIDIZED BED.

Can. J. Chem. Eng., vol. 37:200-203, Oct. 1959. 9 refs.
D. S. Scott, and D. A. Guthrie.
Identifiers: *Mists, *Collectors, Canada, Droplets, Particle size, Filters, Diffusion.

The removal of droplets from a dioctyl phthalate mist by a fluidized bed of silica gel is studied. The mist used has a narrow range of droplet diameters, which average 0.87 micron in size. Silica gel particles are in the range of -150 mesh to +200 mesh. Removal efficiencies are only slightly affected by a 50% change in inlet mist concentration, or by a 300% variation in depth of the fluidized bed. Collection efficiencies vary from about 90% at low superficial gas velocities to 70% at high velocities. Collection is primarily by particle diffusion. Results can be correlated in terms of equations for mass transfer in fluidized beds. The possible uses of a fluidized bed as a collecting device are discussed. (Author abstract modified)
APTIC-22669

### A NEW DEVELOPMENT IN THE PRODUCTION OF BY-PRODUCT AMMONIUM SULPHATE.

Gas World, vol. 143:49-58, March 3, 1956.
(Presented to the Midland Section of the Coke Oven Managers' Association, Sheffield, England, Jan. 18, 1956 and to the Northern Section, Durham, Jan. 26, 1956.)
T. Kennaway, C. W. Wood, and P. L. Box.
Identifiers: *Ammonium compounds, *Sulfates, *Absorption, *By-product recovery, Sulfuric acid.

In the 'Evaporative Process' ammonia is removed from the gas stream by washing the gas with a solution containing dilute sulfuric acid. This solution is then fed to a vacuum evaporator where ammonium sulfate crystals are produced. The development of this process is described in relation to three coke plants with rates of production of salt equal to 6, 25 and 40 tons per day respectively. The basic requirements of a sulfate of ammonia plant are stated and the process is assessed with reference to these. Some comparison is made with conventional processes and an estimate is made on certain economic aspects. The line of future development is indicated. (Author abstract modified)
APTIC-22670

### IMPROVEMENTS IN THE DUST-REMOVING DEVICES OF THE PORCHEVILLE POWER STATION RESULTS OBTAINED.

(Perfectionnements apportes aux depoussiereurs de la centrale de Porcheville resultats obtenus).
Rev. Gen. Thermique (Paris), March 1963, 16p. Translated from French. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 34p., Nov. 3, 1969.
Y. Pradel.
Identifiers: *Steam plants, *Control equipment, *Control methods, *Process modification, France, Particulates, Dusts, Soot, Smokes, Boilers, Centrifugal separators, Electrostatic precipitators, Maintenance, Design criteria, Voltage.

The Porcheville Power Station consists of four 125 MW units, each equipped with a combined mechanical and electrostatic dust-removing device. These units were placed in operation between March 1956 and April 1957. The original dust-removing devices proved to be insufficient, the efficiencies falling to less than 70% under maximum load conditions. A series of modifications were undertaken to improve the efficiency of the devices. These included increasing the time during which the gases remain in the electrostatic precipitator, changing the location of the mechanical collector, cleaning and adjusting the electrodes, improving the soot flow and air-tightness of the chambers, and modifying the electric supply. These changes resulted in a 20 point increase in efficiency; this corresponds to an approximate 5 to 1 reduction in the amount of dust discharged into the atmosphere. The present ob-

jective is to maintain the dust-removing devices in good operating condition by keeping the electrodes clean, accomplishing an optimum adjustment of the rectifier voltage, limiting the number of emitting electrode breakages, and obtaining a perfect adjustment of all mechanical parts of the devices. After the completion of the work in progress, efficiencies of 96% for maximum boiler load and 98% for normal production conditions will be possible. Of particular interest was the benefit obtained by relocating the multicyclones downstream from the electrostatic precipitators. Prior to the relocation the precipitators received only small particles which formed a tightly clinging coating on the electrodes which resisted cleaning agitation. When the relocation of the multicyclones permitted the precipitator to receive larger particles, these interrupted the surface of the coating on the electrodes sufficiently to greatly improve cleaning efficiencies.
APTIC-22671

### EXHAUST EMISSIONS FROM A PASSENGER CAR EQUIPPED WITH A DUPONT EXHAUST EMISSION CONTROL SYSTEM.

Preprint, National Air Pollution Control
Administration, Durham, N. C., Div. of Motor
Vehicle Pollution Control, 4p., May 1970.
John C. Thomson.
Identifiers: *Engine exhausts, *Engine operation modification, Automobiles, Hydrocarbons, Carbon monoxide, Nitrogen oxides.

The exhaust emission characters of a vehicle equipped with a DuPont exhaust emission control system were measured to provide a comparison with other low emission vehicles having the potential to meet 1975 Federal standards. The control system comprised exhaust maniford reactor, exhaust gas recirculation, manifold air injection, particulate traps with special exhaust systems, and carburetor modifications. As determined by constant volume sampling techniques and the 1970 Federal test procedure for exhaust emissions, the DuPont system showed excellent control over hydrocarbons and nitrogen oxides but only minimal control over carbon monoxide.
APTIC-22673

### EMISSIONS FROM STANDARD M-151 JEEP.

Preprint, National Air Pollution Control
Administration, Durham, N. C., Div. of Motor
Vehicle Pollution Control, 6p., Feb. 1970.
Michael A. Caggiano.
Identifiers: *Jeeps, *Automotive emissions, *Air-fuel ratio, *Spark timing, Automobiles, Hydrocarbons, Carbon monoxide, Nitrogen oxides.

Emission tests on a standard Army M-151 jeep consisted of hot and cold starts as received, hot starts with a vacuum advance distributor, and hot starts with leaned idle air-fuel ratio. Emissions were measured simultaneously by the 1970 Federal procedure and a constant volume sampling (CVS) procedure. In addition, nitrogen oxides were measured in the CVS sample bag by the Saltzman technique. All data obtained are summarized in tabular form. In the 'as received' condition, the idle carbon monoxide was seven to eight percent with a warm engine. By reducing the idle carbon monoxide to approximately three percent, seven-cycle hot start hydrocarbons were reduced to about 140 ppm and seven-cycle hot start carbon monoxide about one percent. The vacuum advance distributor increased both hydrocarbons and carbon monoxide, while causing an almost insignificant decrease in nitrogen oxides. (Author summary modified)
APTIC-22674

### THE EFFECT ON EXHAUST EMISSIONS OF THE CETEC ATOM-X DEVICE.

Preprint, National Air Pollution Control
Administration, Durham, N. C., Div. of Motor
Vehicle Pollution Control, 8p., June 1970.
Michael A. Caggiano.
Identifiers: *Combustion, *Engine operation modification, *Engine exhausts, Deposition, Smokes, Automobiles, Fuels, Control methods, Voltage.

Results are presented for tests of a device that reportedly reduced vehicle combustion-chamber deposits and exhaust emissions. The device, which is installed in the fuel line between the fuel pump and carburetor, subjects fuel to a low-intensity magnetic field and a 12-volt electrostatic potential. It was hypothesized that this treatment could beneficially change combustion by affecting the quantity or rate of formation of free radicals. However, while plant evaluations indicated that the device reduced hard carbon deposits and engine knock and caused less smoky exhaust, a 2735 mile road test showed no significant difference in exhaust composition as compared to baseline emission level.
APTIC-22675

### EXHAUST EMISSIONS FROM A TURBOCHARGED TEXACO COMBUSTION PROCESS (TCP) STRATIFIED CHARGE ENGINE.

Preprint, National Air Pollution Control
Administration, Durham, N. C., Div. of Motor
Vehicle Pollution Control, 8p, April 1970.
John C. Thomson.
Identifiers: *Stratified charge engines, *Spark timing, *Timed fuel injection, Automotive emissions, Soot, Smokes, Automobiles, Hydrocarbons, Carbon monoxide, Nitrogen oxides.

Emission data are presented for a turbocharged jeep that operates on a stratified charge, multifuel combustion process. This system utilizes high-pressure cylinder injection of fuel into a controlled inlet air swirl pattern in conjunction with spark ignition. No throttling of the inlet air is required and load control is accomplished by control of the injected fuel quantity only. Emmisions were measured by the 1968 Federal procedure (with a modified correction factor), nine cycles of the seven-mode Federal cycle, and selected hot cycles. Fuels were Indolene 30 used alone or in combination with CITE, or CITE-gasoline mixtures. Mass emission results are summarized. Compared to a standard jeep, the turbocharged jeep with its improved ignition system shows a 10-fold reduction in carbon monoxide, a four-fold reduction in nitrogen oxides, and a reduction of one-half in hydrocarbons. Due to the diesel type combustion, there is some production of soot and smoke. Attempts to measure smoke and odor on the vehicle are to be made in the near future.
APTIC-22684

### EMISSIONS FROM TWO LPG POWERED VEHICLES.

Preprint, National Air Pollution Control
Administration, Durham, N. C., Div. of Motor
Vehicle Pollution Control, 4p., Feb. 1970.
Michael A. Caggiano.
Identifiers: *Engine exhausts, *Automotive emission control, *Propanes, *Compressed gases, Fuel gases, Natural gas, Internal combustion engines, Automobiles, Hydrocarbons, Carbon monoxide, Nitrogen oxides.

Emission measurements were obtained for a 1968 Buick Skylark and a 1969 Ford Galaxie operating on liquid propane gas. The evaluation consisted of the simultaneous collection and measurement of exhaust (during both hot and cold starts) by the 1970 Federal Procedure and Constant Volume Sampling (CVS) Procedure; measurement of the nitrogen oxides content of the sample bag from CVS; reactivity measurement of exhaust by subtractive column analysis of CVS sample bag; and qualitative assessment of vehicle driveability by drivers. As expected, there was a substantial reduction in carbon monoxide emissions. Although the Ford showed a significant reduction in hydrocarbon emissions, the hydrocarbon levels obtained with the liquid propane gas vehicles were not impressive when compared to data for surveillance vehicles with similar engines. Based on the subtractive column data, the hydrocarbons emitted from a propane-fueled engine are less reactive because of the lower olefin and aromatic content of the exhaust. Emissions of nitrogen oxides appear to run as much as 50% higher with propane as the fuel. Driveability of both cars was rated good.
APTIC-22685

### RECOVERY OF SULPHUR.

(Assignee Not Given.) Brit. Pat. 378,668. 8p., Aug. 18, 1932. (Appl. Sept. 7, 1931, 6 claims).
Harold Fairweather, and George Cruikshank.
Identifiers: *By-product recovery, *So2 removal (combustion products), *Reduction, Great britain, Stack gases, Primary metallurgical processing, Baffles, Electrostatic precipitators, Sulfur compounds, Cooling, Temperature.

An improved and economical method for producing elemental sulfur from the sulfur dioxide contained in smelter or roaster gases is described. The hot gases are first sent to a dust collector, such as a baffle chamber or an electrostatic precipitator, at an increased flow velocity to avoid the loss of sensible heat. After leaving the dust collector, the hot gases are introduced into a reduction chamber which has been preheated by the burning of fuel gas or oil. Simultaneously with the introduction of the SO2 gas, the reducing gas is admitted in a suitable proportion for reacting with SO2 to produce elemental sulfur. The temperature of the reduction chamber should be approximately 1000 C to cause the reaction to proceed rapidly. The gases discharged from the chamber are rapidly cooled, preferably to below 500 C, to minimize the formation of carbon oxysulfide. As the gas leaves the reaction chamber, it is passed in a heat-exchange relationship with the reducing gas before its entry into the chamber. The gases are then passed to a waste heat boiler where their temperature is dropped to 300-400 C, and the condensed sulfur is removed.
APTIC-22696

### REDUCTION OF SULFUR DIOXIDE BY CARBON MONOXIDE WITH REDUCED ALUNITE AS CATALYST.

(Vosstanovleniye sernistogo gaza okis'yu
ugleroda s primeneniyem vosstanovlennogo
alunita v kachestve katalizatora). Text in Russian.
Azerb. Khim. Zh., no. 6: 123-127, 1965. 6 refs.
G. B. Shakhtakhtinskiy, and A. L. Guliyev.
Identifiers: *So2 removal (combustion products), *Carbon monoxide, Ussr, Combustion gases, By-product recovery, Sulfur compounds, Catalysts, Reduction.

Laboratory studies showed single-stage reduction of sulfur dioxide with carbon monoxide to give an 86% sulfur yield in the temperature range 500-900 C with gas flow rates of 20-142 ml/min when alunite (K2Al6 (OH)12 (SO4)4) is introduces as a catalyst (as compared to 76% using bauxite catalyst, and 42.8% with no catalyst). An SO2-CO ratio of 1:2.5 was used.
APTIC-22697

### MODERN DESULPHURIZATION PROCESSES IN GERMANY.

Gas-Age Record, 68 (2):37-43, 55-56, July 11, 1931.
H. K. Kronacher.
Identifiers: *Fuel gases, *Desulfurization of fuels, Carbon black, Germany, Coke, By-product recovery, Ammonia, Carbonates, Cyanides, Hydroxides, Iron compounds, Potassium compounds, Sodium carbonate, Nitrogen, Sulfur dioxide, Sulfates, Hydrogen sulfide, Catalytic activity.

With the introduction of long-distance transmission of gas in Germany in the last few years, it has been necessary to desulfurize large quantities of coke-oven gas. This has resulted in the development of a number of new processes, none of which

is absolutely successful. Either the chemical side has not been perfected or mechanical difficulties, such as the question of materials, have not been overcome. The processes can be categorized as combination systems which remove the ammonia with the sulfur in a single operation and those which remove only the hydrogen sulfide. Among the principle combined processes are the Improved Feld Process of the I. G. Farbenindustrie, the C-A-S (cyanide-ammonia-sulfur) Process of H. Koppers, and the Bahr Process. Since these processes work up the ammonia of the gas, their economy is very dependent on the nitrogen market. In both the Improved Feld Process and the C-A-S Process, the oxygen necessary for the formation of sulfate is introduced in the form of SO2 produced by burning sulfur. Three atoms are introduced by this means. The nitrogen of the SO2 gas from roasting escapes to the atmosphere, so the gas is not contaminated. The Bahr Process avoids this roasting by oxidizing the hydrogen sulfide in the gas catalytically. Among the methods that operate independently of ammonia are the I. G. Farbenindustrie dry desulfurzation process with activated charcoal, an alaki carbonate purification process, the Potassium Ferricyanide Process of Fisher, and the Glund-Still Process in which hydrogen sulfide is washed out with a suspension of ferric hydroxide made from a ferrous sulfate solution. Final decisions can not be made on these methods since they have either been in service only a short time or operated only in experimental installations.
APTIC-22699

### SEMIANNUAL PROGRESS REPORT. HARVARD AIR CLEANING LABORATORY. MARCH 1-AUGUST 31, 1969.

Harvard School of Public Health, Boston, Mass.,
Air Cleaning Lab., AEC Contract AT (30-1)841,
77p., Oct. 1969. 17 refs. CFSTI: NYO-841-20
M. W. First, A. S. Goldin, P. C. Reist, D. W.
Underhill, and F. J. Viles Jr.
Identifiers: *Exhaust systems, *Treated fabrics, *Sodium compounds, Aerosols, Reactors (nuclear), Particle size, Glass fabrics, Ventilation, Radioactive radiation.

A summary of various research projects investigating contamination from nuclear reactors is presented. Tests on asbestos-treated glass fabric filters indicate that they are unlikely to meet the needs of a cleanup system for a major sodium fire. There is no need for a pebble-bed heat sink in a cleanup system using high temperature resistant fabric filters. In the case of accidental releases of sodium, normal ventilation through a particulate cleanup system is recommended, followed by surface cleaning activities. For large sodium spills, exhaust systems should be employed. Information on radioactive sodium and iodine aerosols is presented. Physical and chemical properties of sodium aerosols are listed, including particle size and measurement methods. A theory is developed to estimate the amount of sodium deposited on a wall. A system of equations which helps to understand dynamic gas adsorption is derived. (Author summary modified)
APTIC-22705

### ELECTROSTATIC COLLECTION OF FLY ASH.

Preprint, American Society of Mechanical
Engineers, New York, 20p., 1950. 6 refs.
(Presented at the American Society of Mechanical
Engineers, Semi-Annual Meeting, St. Louis, Mo.,
June 19-23, 1950, Paper 50-SA39.)
H. J. White, L. M. Roberts, and C. W. Hedberg.
Identifiers: *Fly ash, *Electrostatic precipitators, Operating variables, Particle size, Rapping, Design criteria, Corona, Electrical resistance, Voltage.

Electrostatic precipitators are widely used for the collection of fly ash. The most important physical properties of fly ash for electrical precipitation are particle size, particle density, and bulk electrical resistivity. Other fly ash characteristics are discussed. The principles of electrostatic precipitation are described, including both theoretical and practical considerations. Precipitator design problems fall into two categories, mechanical and electrical. Mechanical problems include size, materials, ducting, location, corona electrode design, type of electrode, gas flow, rapping, and disposal. Electrical problems include rectifier selection and voltage control. Several methods for combatting variable fly ash conditions are discussed.
APTIC-22707

### A THEORETICAL DESCRIPTION OF THE LIMESTONE INJECTION-WET SCRUBBING PROCESS. (FINAL REPORT).

Radian Corp., Austin, Tex., NAPCA Contract
CPA-22-69-138, Vol. II, 67p., June 9, 1970. CFSTI:
PB 193030
Philip S. Lowell, Delbert M. Ottmers Jr., Klaus
Schwitzgebel, Thomas I. Strange, and David W.
DeBerry.
Identifiers: *Limestone, *Scrubbers, *Alkaline additives, Combustion gases, Computer programs, Mathematical modeling, Simulation, Flow rates.

A theoretical description of the limestone injection-wet scrubbing process is given. Four alternate scrubber models are described in terms of differential equations for flow rates and material balance. Numerical solution for three of the four models must be done by computer. Computer printouts giving compositions for selected process simulations are presented for sulfur dioxide. Computer printouts for chemical equilibrium and program verification are given. Program operating instructions and listings are included.
APTIC-22709

### ADVANCES IN THE MECHANICS OF AEROSOLS.

For primary bibliographic entry see Field 06.
APTIC-22721

### HEAT-RESISTANT FIBROUS MATERIAL.

Khim. Volokna, no. 3:71-75, 1968. 82 refs.
Translated from Russian by D. Koolbeck, Foreign
Technology Div. Wright-Patterson AFB, Ohio,
Translation Div., 17p., Dec. 11, 1969. CFSTI,
DDC: AD 702307
L. I. Bobrov.
Identifiers: *Refractories, *Filter fabrics, Carbon black, Ceramics, Corrosion, Metals, Surface coatings, Ussr, Temperature.

A review is presented of methods of preparing and physical properties of metallic, ceramic, and carbon fibers and heat-resistant fibers with protective coatings. These materials have a number of unique properties: they have high physicochemical indices and retain them at high temperatures; they withstand thermal shock without noticeable loss of strength; some resist temperatures of 2000-3000 C and short-term exposures to temperatures as high as 10,000 C. The materials are used in the filtration of corrosive gases and fluids at high temperature, as reinforcing materials in the manufacture of structural elements based on laminar plastics, in the manufacture of parts operating under ablation conditions and as heat insulation for operation in high-temperature conditions.
APTIC-22724

### SULFUR OXIDES IN WASTE GASES AND IN THE ATMOSPHERE. AN AIR POLLUTION PROBLEM.

(Die Schwefeloxyde in Rauchgasen und in der
Atmosphaere. Ein Problem der Luftreinhaltung).
Text in German. Duesseldorf, Vereins Deutscher
Ingenisure Verlag, 1964, 152p. 53 refs.
Guenter Spengler, and Georg Michalczyk.
Identifiers: *Measurement methods, *Sulfur oxides control, Corrosion, Germany, Combustion gases, Fuels, Coal, Fuel gases, Fuel oils, Analytical methods, Catalytic oxidation, Desulfurization of fuels, So2 removal (combustion products), Absorption (general), Adsorption (general), Dispersion, Sulfuric acid, Ammonia, Nitrogen oxides, Ozone, Sulfites, Catalysts, Reduction.

A general review is presented of the presence of sulfur dioxide and sulfur trioxide in the atmosphere, and the problems relating to this fact. About 80 of the 152 pages are devoted to a description of processes for SO2 removal from waste gases. Among the topics discussed are the sulfur content of fuels, dilution methods, physiological and corrosive effects, and methods and equipment for measuring and evaluating SO2 content. Among the removal processes discussed are the various types of organic and inorganic absorption media, adsorption processes, metals and metallic oxides, reactions with various gases, and the desulfurization of solid, liquid, and gaseous fuels.
APTIC-22740

### ELECTROFILTERS WITH A ROTATING FIELD.

(Elektrofil'try s vrashchayushchimsya polem).
Text in Russian. Izv. Vyssh. Ucheb. Zaved.
Elektromekh., no. 3:223-233, 1968. 9 refs.
S. A. Levitan, and E. V. Dmitriyev.
Identifiers: *Mathematical analyses, *Electrostatic precipitators, Ussr, Dusts, Particle size, Design criteria, Flow rates, Voltage, Temperature.

Two devices for electrostatic dust removal are examined theoretically. These devices are arranged as follows: 1) three electrodes forming 120-degree segments of a cylinder, the three segments being connected to a three-phase high-voltage source; and 2) a series of cylinders arranged parallel between one charged and one grounded plate, the charged plate and alternating cylinders being each connected to one terminal of a three-phase high-voltage source. A model of the second type filter, comprised of 8 cylindrical elements and operating with an applied voltage of 19 kv, gave 96% dust removal from a flow containing 50-200 g/cu m dust (iron oxide, sulfur, small amounts of iron and copper sulfates, quartz, and certain silicates; particle diameter up to 40 millimicron at a flow velocity of 0.5 m/sec and a temperature of 600 C.
APTIC-22741

### STUDY OF STACK-GAS FLOW ON LSD28- AND LSD32-CLASS SHIPS FROM TESTS WITH MODEL 4552 IN THE CIRCULATING WATER CHANNEL.

For primary bibliographic entry see Field 14.
APTIC-22742

### PLATING PLANT PAYS OFF ONE WASTE ON ANOTHER.

Chem. Eng., 69 (12):98, June 11, 1962.
Personal Author Not Recorded.
Identifiers: *Metal fabricating and finishing, *Water pollution, *Scrubbers, *So2 removal (combustion products), Costs, Stack gases, Plating, Inorganic acids, Chromium compounds.

A plant that produces chrome-plate parts has reduced the costs of removing chromic acid from liquid wastes by utilizing the sulfur dioxide contained in its powerhouse flue gas. In doing so, the plant carries out a low-cost technique for avoiding water pollution, while also lessening air pollution. About 10% of the gas is passed to a scrubbing tower where it contacts the liquid waste. Part of the liquid stream enters near the top of the tower, part near the midsection; in both cases, spray nozzles direct the material downward. Overall treatment includes a number of passes through the scrubber, followed by final reduction with sodium bisulfate. Solids are separated from the liquid and passed to a sludge bed for drying. The liquid passes through a sampling device and then to the sewer. The overall cost of waste treatment is now about 25% of what it was previously.
APTIC-22743

### $SO_2$ STACK GAS GIVES $(NH_4)_2SO_4$.

Chem. Eng. News, 44 (26):23, June 27, 1966.
Personal Author Not Recorded.
Identifiers: *By-product recovery, *Catalytic oxidation, *So2 removal (combustion products), Costs, Japan, Stack gases, Pilot plants, Ammonium compounds, Vanadium compounds, Oxides, Sulfates.

A promising new dry process developed in Japan is described that only removes sulfur dioxide from stack gases but converts it to salable ammonium sulfate suitable for direct use as fertilizer. According to the process, which is the first to produce $(NH_4)_2SO_4$ in a gas-phase reaction, $SO_2$ in a flue gas is oxidized to $SO_3$ over vanadium pentoxide at 380 to 450 C. Moisture in the gas reacts with the $SO_3$ to form sulfuric acid. Ammonia gas is then injected into the system to form pure $(NH_4)_2SO_4$ crystals. Main advantages of the process are favorable economics, avoidance of corrosion, cost credit of a salable end product, possible use of cheap, high-sulfur fuels, and possible partial alleviation of the sulfur shortage. A large pilot plant is now under construction in Japan. Cost estimates are given.
APTIC-22745

### REMOVAL OF PARTICULATE MATTER FROM GASEOUS WASTES. GRAVITY, INERTIAL, SONIC, AND THERMAL COLLECTORS.

Cincinnati Univ., Ohio, Dept. of Chemical
Engineering, American Petroleum Institute
Engineering Rept., 12p., 1961. 29 refs.
Chad F. Gottschlich.
Identifiers: *Collectors, *Design criteria, Particulates, Dusts, Impingers, Centrifugal separators, Gravity settling, Inertial separation, Mathematical analyses.

A compilation and, where possible, a critical evaluation of current published (and some unpublished) information on four types of collectors is presented. Sufficient theory and experimental work are included to permit an evaluation of the design and use of miscellaneous dust collectors proposed for a given duty. The theory of gravity settling chambers is elaborated. Inertial collectors are reviewed in terms of skimmers, louver-type dust separators, centrifugal impeller collectors, mechanical gas centrifuges, and impingement separators (body collectors and impingement separators using jets). Brief discussions are given of the mechanism of sonic agglomeration and thermal precipitation. A glossary of theoretical notation is included.
APTIC-22746

### CONSTRUCTION AND TESTING OF A JUNK AUTO INCINERATOR.

Bureau of Mines, Washington, D. C., Tech. Prog.
Rept. 21, 8p., Feb. 1970. 4 refs. CFSTI: PB-190645
C. J. Chindgren, K. C. Dean, and J. W. Sterner.
Identifiers: *Incineration, *Automobiles, Costs, Stack gases, Natural gas, Pilot plants, Ringelmann chart, Flame afterburners, Design criteria.

A refractory-lined, garage-type automobile incinerator with a natural gas afterburner for air pollution control is described. Construction and testing methods are discussed. The incinerator is capable of relatively smokeless burning of 32 to 60 cars per day, depending on the degree to which the cars are stripped prior to incineration. Observations with a Ringelmann chart indicates that the incinerator produces a stack effluent of No. 1 Ringelmann or less for over 97% of the burning period. Slightly better results are possible, indicating that the incinerator should meet or exceed clean air standards. Preliminary burning campaigns indicate the cost of incineration to be approximately $2.75 per car. (Author abstract modified)
APTIC-22747

### REDUCTION OF SULPHUR DIOXIDE.

Eng. Mining J., 131 (1):7, Jan. 12, 1931. 1 ref.
George J. Young.
Identifiers: *So2 removal (combustion products), *Reduction, *Natural gas, By-product recovery, Carbon monoxide, Sulfur compounds, Condensation, Temperature, Combustion gases.

Although reduction of sulfur dioxide by carbon monoxide, marsh gas, or hydrogen sulfide is not new, laboratory-scale experiments demonstrate that the reduction process can be improved by the use of a simple contact mass under controlled temperature conditions. In the experiments reported, a cylindrical chamber, electrically heated to 800-1200 F, contained the contact mass through which sulfur dioxide mixed with natural gas or carbon monoxide was passed. Through exothermic reactions the contact mass discharged a gas from which elemental sulfur condensed. Apparently the reaction was complete, as there was no noticeable sulfur dioxide in the air. In view of the cheapness of natural gas in many localities, the experiments appear important enough to warrant thorough investigation of the relation of the weight and surface exposure of the contact mass per unit of volume of diluted gases, the chemical balance necessary, and the amount of reducing agent required to insure burning of oxygen in the gas to be treated.
APTIC-22748

### ACCOUNTING FOR ATMOSPHERIC TURBULENCE WHEN SELECTING THE CAPACITY AND HEIGHT OF INDUSTRIAL CHIMNEYS.

For primary bibliographic entry see Field 14.
APTIC-22749

### TWO-STAGE OXIDATION OF WASTE GASES FROM CARBON DISULFIDE PRODUCTION.

(Dvukh stupenchatoye okisleniye
otkhodyashchikh gazov serouglerodnogo
proisvodstva). Text in Russian. Khim. Volokna, 4
(2):38-40, 1962.
K. Ye. Perepelkin, B. S. Aranovich, and P. D.
Kovin.
Identifiers: *By-product recovery, *Catalytic oxidation, *Carbon disulfide, Ussr, Combustion gases, Chemical processing, So2 removal (combustion products), Aluminum oxides, Carbon monoxide, Hydrogen sulfide, Sulfites, Catalysis, Catalysts, Temperature.

A simplified two-stage combustion-oxidizer unit using bauxite catalyst in the second stage yielded at least 10% more sulfur than a conventional Claus furnace. The combustion chamber is operated at 700-900 C; the catalysis chamber, at 270-350 C. This unit is economical to build, reliable and easy to operate, and is recommended for all new or modernizing installations.
APTIC-22750

### THE DETERMINATION AND CONTROL OF INDUSTRIAL DUST.

For primary bibliographic entry see Field 03.
APTIC-22751

### DEVELOPMENT OF A MOLTEN CARBONATE PROCESS FOR REMOVAL OF SULFUR DIOXIDE FROM POWER PLANT STACK GASES. PART IV. CONTRACTOR DEVELOPMENT.

Contract PH 86-67-128, AI-70-8, PR-2, 56p., 1968.
10 refs. CFSTI: PB 191960
Personal Author Not Recorded.
Identifiers: *Absorption (general), *Carbonates, Stack gases, Fly ash, Electric power production, Baffles, Scrubbers, Lithium compounds, Potassium compounds, Sodium carbonate, Nitric oxide (no), Flow rates, Reaction kinetics.

Gas-liquid chemical absorption reactors were studied for application to a molten carbonate sulfur-removal process. Exploratory experiments showed that absorption of sulfur dioxide in a eutectic mixture of lithium, potassium, and sodium carbonates is very rapid. A continuous wetted-wall absorber demonstrated that the rate of sulfur dioxide absorption in carbonate is limited by mass transfer in the gas phase. To demonstrate that high efficiency of sulfur dioxide absorption is possible in a continuous reactor, a 2 in. column fitted with baffles was assembled. The baffles created the necessary turbulence to allow virtually complete sulfur dioxide removal. The transfer unit height (HTU) of the baffled column was 7 in. compared with approximately 70 in. required for a sulfur dioxide HTU in an unbaffled column. The absorption of nitric oxide was also tested with the baffle column. Experimental results indicated that nitric oxide reacts slowly in the carbonate melt. The transfer unit height for nitric oxide ranged from 38 to 111 in. Nitric oxide did not significantly alter the absorption of sulfur dioxide. Sulfur dioxide was absorbed in a spray of molten carbonate under three conditions: low-velocity gas flow (less than 2 ft/sec), low-velocity gas flow with fly ash added to the sprayed carbonate, and high-velocity gas flow (approximately 25 ft/sec). In the low-velocity tests, the percent of sulfur dioxide removed from simulated flue gas varied with the fineness of the spray and with the amount of carbonate in excess of the stoichiometric requirement. Mist-like sprays allowed 99.9+% sulfur dioxide removal. (Author abstract modified)
APTIC-22756

### MODIFICATION TO REDUCE EMISSIONS FROM A FLUE-FED INCINERATOR.

New York Univ., N. Y., Research Div., Tech.
Rept. 552.2, 51p., June 1959. 8 refs. (Presented at
the Air Pollution Control Assoc. Annu. Meet.,
52nd, Los Angeles, Calif., June 1959.)
E. R. Kaiser, J. Halitsky, M. B. Jacobs, and L. C.
McCabe.
Identifiers: *Costs, *Single chamber incinerators, *Control equipment, *Control methods, Combustion products, Ashes, Cinders, Combustion gases, Particulates, Scrubbers, Firing methods, Overfire air, Fuel charging, Field tests, Combustion, Flow rates.

A program of 38 tests was conducted on three flue-fed, single-chamber, refuse incinerators in three 16-story apartment buildings to determine the amount of atmospheric pollution from the incinerator flues and the effectiveness of several appliances in reducing the emission of atmospheric contaminants from such incinerators. Tests were conducted on the use of overfire air jets, supplemental gas firing, a stainless-steel secondary combustion chamber, a method of high-rate combustion, and a flue-gas scrubber. The devices are illustrated, test methods described with resulting data, and the emissions are reported and compared with those from the unmodified incinerators. Estimated investment and operating costs for the incinerator modifications are included. Emissions of atmospheric contaminants from the incinerator flues can be reduced by each of the following methods, and that the best results are obtained by all of them in combination: by hopper locks to prevent the charging of loose particles of dust, paper, lint, etc., while the velocities in the flue are high, as when refuse is burning; by appliances that promote better combustion in the furnace; by care taken by the incinerator operator to limit the flow of air through the grate during burning and through and over the residue during its removal; and by scrubbing the flue gas before discharge to the atmosphere. (Author summary modified)
APTIC-22757

### REMOVAL OF SULFUR DIOXIDE FROM INDUSTRIAL GASES.

(Ochistka promyshlennykh gazov of dvuokisi
sery). Text in Russian. Izv. Vysshikh. Uchebn.
Zavedenii Khim. i Khim. Tekhnol., 9 (1):89-93,
1966. 2 refs.
I. E. Kuznetsov, and S. N. Ganz.
Identifiers: *Spray towers, *Absorption (general), Ussr, Sodium compounds, Sodium carbonate, Flow rates, Density, Temperature.

An experimental study of sulfur dioxide removal using an open equiflow spray tower with a cen-

trifugal volumetric sprayer demonstrated that such an arrangement can significantly reduce the size and cost of such equipment. Data are reported on the effect of sprayer rotation rate, volumetric gas flow rate, irrigation density, absorbent (Na2C03) concentration, temperature, and gas concentration on SO2 removal. Dimensionless equations are presented for the SO2--Na2CO3 solution system.
APTIC-22762

### FILTERS WITH ELASTIC WALLS.

(Fil 'try s elastichenymi stankami). Text in Russian. Zh. Prikl. Khim., 41 (6):1343-1344, 1968. 1 ref.
G. P. Lysenko, and V. T. Severin.
Identifiers: *Elasticity, *Filters, *Absorption (general), Ussr, Humidity, Sodium hydroxide, Flow rates, Temperature.

Sulfur dioxide absorption experiments using a column filter having a thin (1-6 mm) polyvinyl chloride wall and charged with sodium hydroxide demonstrated the effectiveness of using elastic filters to reduce the adverse effect of compaction of the charge mass as it expands under use. Tests were made with column lengths of 3-35 cm at a flow rate of 0.3 l/min-sq cm. Sulfur dioxide content of the flow was 1%; relative humidity, 50-70%; and temperature, 15-20 C. Flow resistance after 8 hours of operation increased only 1.5-fold as compared to 12-fold with rigid walls. Filter cross section increased (1.1-1.4)-fold while specific flow velocity decreased (1.05-1.1)-fold.
APTIC-22764

### KINETICS OF ANODE EXTRACTION OF SULFUR FROM MOLTEN SLAGS.

(Kinetika anodnogo udaleniya sery iz rasplavlennykh shlakov). Text in Russian. Izv. Vyshikh Uchebn. Zavedenii Chernaya Met., 10 (3):10-14, 1967. 6 refs.
V. N. Boronenkov, O. A. Yesin, G. A. Toporishchev, and A. S. Churkin.
Identifiers: *Electric furnaces, *By-product recovery, *Sulfur compounds, Ussr, Primary metallurgical processing, Boron compounds, Calcium compounds, Aluminum oxides, Silicon dioxide, Reaction kinetics, Reaction mechanisms.

Experimental anode extraction of sulfur was carried out with slag containing 33.6% calcium oxide, 33.6% aluminum oxide, 28% boron oxide and 4.8% silicon dioxide. Results obtained indicated that increased sulfur yield in terms of anode current requires a current lower than that previously used and selected on the basis of sulfur content and intensity of mixing. For example, with natural convection and a CaS concentration of 2%, a high sulfur yield (80% in terms of current) may be achieved with a current of 0.15 a/sq cm.
APTIC-22765

### IMPACTION OF AEROSOL PARTICLES IN THE NEIGHBOURHOOD OF A CIRCULAR HOLE.

Collection Czech. Chem. Commun. (Prague), vol. 29:2223-2227, 1964. 2 refs.
J. Pich.
Identifiers: *Impaction, *Aerosols, *Membrane filters, Czechoslovakia, Mathematical analyses.

In connection with studies of the mechanism of membrane ultrafilter action, a problem arose in estimating inertial impaction efficiency of aerosol particles from a stream of gas around a circular hole. In order to evaluate the role of impaction in the mechanism, an approximate relation was derived for the efficiency of impaction. The equations for impaction efficiency are presented and analyzed. The efficiency is expressed as a function of two dimensionless parameters; the geometrical parameter alpha equals R/d and the inertial parameter (Stokes' number Stk). (Author abstract modified)
APTIC-22767

### PRODUCTION OF SULFUR BY REDUCTION OF SULFUR DIOXIDE WITH COKE IN A FLUIDIZED BED.

(Polucheniye sery vosstanovleniyem dvuokisi sery koksom v psevdozhizhennom sloye). Text in Russian. Khim. Prom. (Moscow), no. 11:844-848, 1962. 11 refs.
L. G. Ritter, V. S. Udintseva, and L. L. Mirolyubova.
Identifiers: *Coke, *By-product recovery, *So2 removal (combustion products), *Reduction, Ussr, Combustion gases, Hydrogen sulfide, Temperature.

The degree of reduction of sulfur dioxide and yield of elemental sulfur increases as coke grain size decreases; the increase is especially sharp with grain size below 1 mm. Reduction takes place at lower temperatures when coke particles are fine. With a reactor height of 20 m and reaction temperature of 900 C, SO2 reduction reached about 80% without catalytic reduction of organic sulfur compounds and hydrogen sulfide. Various types of coal were also tried and gave sulfur yields comparable to that of coke (65-85%). Maximum sulfur yield was achieved when SO2 content of the gas leaving the fluidized bed was 0.5-1%.
APTIC-22768

### PROCESS FOR RECOVERING ELEMENTAL SULPHUR FROM SULPHUR GASES.

(Assignee Not Given.) Brit. Pat. 2834. 4p., Feb. 22, 1916. (Appl. Feb. 22, 1915, 2 claims).
William Francis Lamoreaux, and Charles William Renwick.
Identifiers: *By-product recovery, *So2 removal (combustion products), *Reduction, *Electrolysis, Stack gases, Coke, Primary metallurgical processing, Sulfur oxides, Sulfur compounds, Temperature.

An improved process is presented for recovering sulfur from sulfur oxides liberated by the smelting, roasting, or calcining of pyrite ores and other sulfur-containing material. In particular, it is concerned with maintaining a bed of incandescent coke at the temperature required for the rapid and nearly quantitative reduction of sulfur compounds to elemental sulfur. When the heat necessary for the reaction is obtained solely by the combustion of heat-producing materials, the products of combustion will combine or mix with the gas to be treated and vitiate the desired results. To avoid this, the invention supplies the increment of heat necessary for complete reduction of sulfur dioxide from a source independent of the oxidation of the carbon in the gas stream. The increment is obtained by passing an electric current through furnace electrodes and then through the bed of glowing coke in the presence of the gas.
APTIC-22770

### PROCESS AND APPARATUS FOR THE COMMERCIAL EXTRACTION OF SULPHUR FROM GASES RICH IN SULPHUROUS ANHYDRIDE.

(Assignee Not Given.) Brit. Pat. 20,716. 5p., Sept. 14, 1914. (Appl. Sept 13, 1913, 2 claims).
Lucien Paul Basset.
Identifiers: *Reduction, *By-product recovery, France, Combustion gases, Coke, So2 removal (combustion products), Sulfur compounds, Condensation, Water, Vapors.

The extraction of sulfur from sulfurous gases is of commercial interest, since the price of sulfur is about double that of sulfurous acid. A practical and economic removal procedure is provided by the invention, which is based on passing purified industrial gases rich in sulfurous anhydride into a column containing coke heated to a red heat. The products resulting from the reaction between the gases and the coke carbon disulfide, carbon oxysulfide, and carbon monoxide are then mixed, in a second reaction chamber, with excess sulfurous anhydride to insure their complete oxidation to sulfur vapor mixed with carbonic acid. The sulfur is condensed from the vapor in the form of liquid sulfur or flowers of sulfur. Because the reactions are entirely exothermic, the desired temperature in the reaction chambers is maintained by suitably lagging the sides and, if necessary, by preheating the gases.
APTIC-22771

### PROCESS FOR PURIFYING GASES FROM ORGANICALLY COMBINED SULFUR.

(Assignee Not Given.) Brit. Pat. 282,634. 1p., Jan. 24, 1929. (Appl. Oct. 25, 1927, claims not given).
Franz Fischer.
Identifiers: *Organic sulfur compounds, *Catalysts, *Reduction, Germany, Control methods, Hydrogen, Silver compounds, Sulfur compounds, Hydrogen sulfide, Catalysis, Gases, Water, Temperature.

The invention relates to the catalytic purification of gases, such as water-gas, containing organic sulfur compounds by the use of precious metals, especially silver, of the first group of the periodic system. Unlike iron, cobalt, or nickel catalysts, these metals do not change the composition of the gas to be treated. In addition, the recommended catalysts operate at considerably lower temperatures of about 200-300 C. They serve to convert the organic sulfur compounds to sulfuretted hydrogen, which is removed by the usual methods. Metallic silver for the reaction can be obtained by impregnating asbestos fibers with a solution of silver nitrate which is converted to silver oxide by drying and calcining. On contact with the sulfur compounds, the silver is reduced to metallic silver, whereupon the catalytic action begins.
APTIC-22772

### THE CATALYTIC OXIDATION OF SULFUR DIOXIDE WITH VANADIUM CATALYST.

For primary bibliographic entry see Field 06.
APTIC-22773

### REMOVAL OF CARBON MONOXIDE FROM INTERNAL-COMBUSTION ENGINE EXHAUST.

(Ochistka otrabotavshikh gazov dvigateley vnutrennego sgoraniya ot okisi ugleroda). Text in Russian. Soobshch. Akad. Nauk Gruz. SSR, 49 (1):103-108, 1968. 3 refs.
V. Sh. Bakhtadze.
Identifiers: *Internal combustion engines, *Automotive emission control, *Catalytic oxidation, *Carbon monoxide, Ussr, Engine exhausts, Manganese compounds, Carbon dioxide, Catalysts, Flow rates, Temperature.

Catalytic oxidation of 3-4% carbon monoxide in engine exhaust containing 2-3% CO2 and 14-15% 02 using catalysts prepared from manganese dioxide ore (91.06% MnO2) was studied at temperatures ranging 200-650 C and a volumetric flow rate of 10,000-20,000 inverse hours. Static tests of one of these catalysts in a type KNG-M neutralizer attached to a model ZIL-122 engine operated with a K-22 carburetor on grade A-72 fuel gave 65-100% carbon monoxide removal; efficiency decreased with increasing engine rpm.
APTIC-22776

### THE BOUNDARY LAYER INSIDE A CONICAL SURFACE DUE TO SWIRL.

J. Appl. Mech., Paper 56-APM-31, p. 1-6, 1956. 3 refs. (Presented at the National Conference of the American Society of Mechanical Engineers Applied Mechanics Div., Urbana, Ill., June 14-16, 1956.)
H. E. Weber.
Identifiers: *Boundary layer, *Dusts, *Centrifugal separators, Operating variables, Mathematical analyses, Fluid flow, Flow rates.

In a cyclone dust separator, the tangential velocity components are much greater than the axial and radial components except in a region near the cyclone axis and in the boundary layers near the walls. An analysis of the axially symmetric boundary layer on the inside of a conical surface due to

swirl flow about the conical axis is presented. The momentum integrals of the boundary layer are derived, and both the laminar and turbulent boundary-layer solutions are obtained numerically. In the free stream the flow is assumed to be a potential vortex. A comparison between theory and experiment is made by using the particle paths on the conical surface of a cyclone dust separator. (Author abstract modified)
APTIC-22778

### HEAD LOSS IN FLOW THROUGH A CYCLONE DUST SEPARATOR OR VORTEX CHAMBER.

J. Appl. Mech., Paper 56-A8:1-6, 1956. (Presented at the American Society of Mechanical Engineers Applied Mechanics Division, Annual Meeting, New York, Nov. 25-30, 1956.)
H. E. Weber, and J. H. Keenan.
Identifiers: *Centrifugal separators, *Flow rates, Dusts, Mathematical analyses, Pressure.

An analysis for predicting the head loss in flow through a cyclone dust separator is presented. The effect of wall friction is indicated by consideration of two cases: one for zero wall friction, the other for wall friction great enough to eliminate the angular momentum of the stream. Comparisons of the analysis are made with the experimental data obtained from a test cyclone in which the flow rate, the depth of the inlet area, the radius of the exhaust pipe, and the extension of the exhaust pipe into the cyclone were variable. In general, the agreement between the theoretical and experimental results is good. The regions of deviation between the two results are evaluated qualitatively with respect to the effects of wall friction on the head loss. (Author abstract)
APTIC-22779

### HYDRODESULFURIZATION OF THE VACUUM DISTILLATE FROM ROMASHKINO CRUDE OIL.

(Hydrogenacni odsireni vakuovehodestilatu romaskinovske ropy). Text in Czech. Sb. Pr. Vzyk. Chem. Vyuziti Uhli, Dehtu Ropy, vol. 8:40-62, 1968. 3 refs.
Jaroslav Veprek, and Jaroslav Novak.
Identifiers: *Hydrodesulfurization, Czechoslovakia, Hydrogen, Cobalt compounds, Molybdenum compounds, Nickel compounds, Aluminum oxides, Hydrogenation, Flow rates, Pressure, Temperature.

The effects of pressure, temperature, and raw material velocity on the hydrodesulfurization of the vacuum distillate from a crude oil were studied in a through-flow apparatus. Catalysts used were Co-Mo/Al203 and Ni-Mo/Al203 at pressures from 40-150 atm. Temperature was varied from 335 to 409 C. Velocity of the raw material was 1-4 l/l/hr and the volume ratio of the hydrogenation gas (75% hydrogen) to the crude oil was 300:1. Using the Co-Mo/Al203 catalyst at 150 atm and 390 C with a raw material velocity of 2 l/l/hr, a 0.2% sulfur content product was obtained from a 2% sulfur crude oil. The Ni-Mo/Al203 catalyst was more active both in the desulfurization process and in the cracking of fractions up to 390 C. Also, removal of the basic components was better (90%) using the Ni-Mo/Al203 catalyst.
APTIC-22780

### EMISSION LIMITED CITY CARS FOR METROPOLITAN AREAS.

Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1968, 17 refs. (Presented at the Society of Automotive Engineers, Mid-year Meeting, Detroit, Mich., May 20-24, 1968, Paper 680431.)
Manfred Altman, and Thomas H. Floyd.
Identifiers: *Urban areas, *Storage batteries, *Internal combustion engines, Feasibility studies, Automotive emissions, Mass transportation, Electric propulsion, Engine design modification, Design criteria.

A study was undertaken to determine the feasibility of designing an economical, emission limited small vehicle, and also to devise a system which would utilize these vehicles in a manner which would benefit the 'city' and also the urban traveler. An investigation of several power sources showed that a hybrid consisting of a battery and a small internal combustion engine was optimal. The proposed vehicle would be about 9 ft long, seat three adults, have an automatic transmission, and could operate on batteries only in restricted areas such as tunnels and garages. Pollutants would be one-tenth of that of present day standard automobiles. As originally envisioned, a fleet of these cars would have been made available to riders of mass transportation media at city terminals for use within the central business districts only. An additional possibility is to allow commuters to take a vehicle home overnight. A commuter might bring a vehicle into town, drop it near his place of work, and make it available to other users during the day. The vehicles can be designed so as to make it possible to park 'head in' and to fit three or four vehicles into the space normally needed for one auto. (Author summary modified)
APTIC-22783

### HUMAN AND TRAFFIC CONTROL FACTORS IN AUTOMOTIVE EXHAUST EMISSION.

For primary bibliographic entry see Field 01.
APTIC-22784

### VEGETATION AS AEROSOL FILTER.

For primary bibliographic entry see Field 14.
APTIC-22786

### EVALUATION OF THE PENETRATION CHARACTERISTICS OF A HORIZONTAL PLATE ELUTRIATOR AND OF A 10MM NYLON CYCLONE ELUTRIATOR.

Bureau of Mines, Washington, D. C., Rept. of Investigations 7367, 9p., March 1970. 13 refs. CFSTI: PB 190651
Thomas F. Tomb, and Lewis D. Raymond.
Identifiers: *Elutriators, *Dusts, *Centrifugal separators, Equipment criteria, Respiratory system, Coal, Particle size, Collectors, Flow rates, Density.

The penetration characteristics of a horizontal plate elutriator and of a 10-mm nylon cyclone were evaluated. The test aerosols were polydisperse coal-dust particles with diameters from less than 0.3 to 15 micrometers. Particle densities were 1.3 to 1.4 gr per cu cm. Equivalent Stokes diameter were measured by Coulter counter analytical techniques. The penetration characteristics of the horizontal plate elutriator closely approximate the sampling efficiency curve defining the respirable fraction of the dust cloud recommended and adopted by the Johannesburg Pneumoconiosis Conference in 1959. Penetration characteristics of the 10-mm cyclone were evaluated at flow rates of 1.4, 1.5, 2.0, 2.5, and 2.8 liters of air per min. The data indicate that the penetration curve obtained at 2.0 liters per min most closely approximates the sample efficiency curve for respirable dust recommended at a meeting sponsored by the U. S. Atomic Energy Commission in 1961. (Author abstract modified)
APTIC-22792

### DIAGRAMS FOR THE ESTIMATION OF SMOKESTACK HEIGHT NECESSARY FOR A POLLUTION-FREE ATMOSPHERE.

For primary bibliographic entry see Field 14.
APTIC-22793

### PROBLEMS IN THE WET EXTRACTION OF DUST FROM GASES.

(Probleme der Nassentstaubung von Gasen). Text in German. Keram. Z., 21 (8):484-489, Aug. 1969. 8 refs.
E. Weber.
Identifiers: *Dusts, *Operating variables, *Scrubbers, Germany, Stack gases, Particle size, Diffusion, Aerodynamics, Condensation, Flow rates.

The basic problem of wet dust separation is to bring about contact of all dust particles contained in a gas with the washing liquid. The question of the quantitative influence of diffusion and of secondary and condensation effects on results of wet dust separation is hitherto unresolved, but a condition under which junction of dust particles and of water drops occurs under the influence of inertia can be calculated from relative speeds of the particles and drops and from their sizes. While a collision of particles 0.5 and 0.05 micron in diameter with water drops is unlikely, such particle sizes play a subordinate role; and inertia, together with aerodynamic processes, govern the collision of dust particle with water drops. Calculations revealed that dust separation effectiveness increased with an increase of relative flow velocity and with a decrease in water drop size. Because of the hitherto undetected influences on drop formation, it is difficult in wet dust arresters to produce the particular drop size which has been calculated to be best for separation. It is thus not yet possible to calculate the degree of dust separation expected of a particular equipment model. Such a prediction must rely on empirically derived relationships which are based on the assumption that a correlation exists between the amount of energy expended on dust separation and dust separating efficiency.
APTIC-22795

### CONTEMPORARY FILTERING MATERIALS FOR PURIFICATION OF FUELS, OILS, AIR AND HYDRAULIC FLUIDS.

Energomashinostroenie (Moscow), no. 11:40-42, 1968. 7 refs. Translated from Russian. Foreign Technology Div., Wright Patterson AFB, Ohio, Translation Div., 7p., Oct. 23, 1969. CFSTI, DDC: AD 702311
S. A. Puzyrev, G. P. Kuchin, and P. S. Osipov.
Identifiers: *Cellulose, *Filter fabrics, Ussr, Fuel oils, Internal combustion engines, Filters, Surface properties.

Soviet and foreign cellulose filter materials were compared with respect to thickness, weight, maximum pore dimension, breaking load, breaking point, resistance to air flow, and permeability. The foreign materials included both impregnated and unimpregnated samples. Domestic materials tested included filters for the purification of air, fuel, and fuel oils. Differences in physical and strength indices between Russian and foreign filters are attributed to differences in technical requirements. The latter necessitate different forms of filtering blinds and, in the case of Russian filters, filters adaptable to the higher pressure of the lubrication systems in Soviet engines. The finer fibers in the Soviet products gave high filtration through thinner layers of filter material. On the other hand, the less stringent fineness requirements for foreign filters resulted in higher values of specific carrying capacity and thus in increased service lives of the elements. Basic parameters of filter materials for fine purification of oils and air of internal combustion engines were very close, and the foreign filters 1/i8/ T3/202 are recommended both for purification of oils and air.
APTIC-22797

### ABATEMENT OF SULFUR OXIDE EMISSIONS FROM STATIONARY COMBUSTION SOURCES.

NAPCA Contract CPA 22-69-31, COPAC-2, 75p., 1970. 27 refs. CFSTI: PB 192887
Personal Author Not Recorded.
Identifiers: *Research programs, *Electric power production, *Sulfur oxides control, Control programs, Costs, Federal governments, Combustion gases, Coal, Steam plants, Desulfurization of fuels, So2 removal (combustion products), Alkaline additives, Sulfur compounds.

In surveying the sulfur oxide problem and U. S. energy requirements, it is estimated that the requirement for electricity will more than triple in the next 20 years and that the use of coal will triple by the year 2000. These projections are related to longterm environmental considerations, energy research, factors of fuel utilization, and time phases of technical developments. Support of technology development by the coal industry, equipment manufacturers, utilities, and the federal government is surveyed, and the present status of research and technology is reviewed, including brief discussions of numerous specific processes. It is concluded that commercially proven technology for control of sulfur oxides from combustion processes does not exist and that a high level of government support is needed in addition to industry commitments to develop the necessary control measures. Certain control approaches are suggested for support, and a 5-year plan for future work is presented in which complete development of the limestone process is given high priority. Elemental sulfur is considered a more desirable by-product than sulfuric acid or sulfur dioxide, and the technology and costs of this conversion need thorough study.
APTIC-22800

### HAZARDS OF LNG SPILLAGE IN MARINE TRANSPORTATION. FINAL REPORT.

Bureau of Mines, Washington, D. C., MIPRZ-70099-9-92317, SRC Rept. 5-4105, 35p., Feb. 1970. 19 refs. CFSTI, DDC: AD 705078
D. S. Burgess, J. N. Murphy, and M. G. Zabetakis.
Identifiers: *Hazards, *Natural gas, *Compressed gases, Oceans, Transportation, Field tests, Mathematical analyses, Dispersion, Inversion, Heat transfer, Volatility.

An investigation of the hazard of spillage of liquefied natural gas (LNG) onto water is described. About 2000 gallons of LNG were consumed in various small-scale laboratory tests on heat transfer, vaporization, underwater release, and foaming, and large-scale tests conducted on an artifical pond on spill and dispersion. The initial vaporization rate of LNG following spillage was found to be 0.037 lbs/ft 2 sec; when the spill was confined, this vaporization rate was moderated after about 20 sec by the growth of an ice layer on the water surface; when the spill was unconfined, a coherent ice floe was not observed and the vaporization rate was essentially time-independent. The maximum diameter (in feet) of the spreading LNG pool was found to be given by 6.3 W to the 1/3 power where W is the weight of LNG in pounds. Downwind of a natural gas source, time-averaged methane concentrations were given in good approximation by standard air pollution equations. However, peak concentrations were as much as twentyfold higher than average, adding an additional factor to the assessment of hazard. The effect of layering by the cold vaporized natural gas was similar to the effect of a temperature inversion on normal gases in the atmosphere. None of these conclusions were felt to dictate an adverse decision concerning LNG transportation. However, unexplained small-scale explosions observed on pouring LNG onto a water surface should be further investigated. (Author abstract modified)
APTIC-22805

### POTOMAC ELECTRIC POWER COMPANY STATEMENT.

Preprint, 32p., 1967. (Presented at the Interstate Air Pollution Abatement Conference National Capital Metropolitan Area, Washington, D. C., 1967.)
Dorsey F. Hughes.
Identifiers: *Electric power production, *Sulfur oxides control, Washington d c, Stack gases, Coal, Stacks.

The Potomac Electric Power Company operates three in-city steam-electric generation stations in the Washington metropolitan area and two stations 30 miles distant from the District of Columbia. In addition, another station is under construction on the extreme fringe of the Washington area. For its in-city plants, the company is making every effort to procure low-sulfur coal. This approach, however, is not considered feasible for the larger suburban stations. To obtain adequate, assured quantities of one percent sulfur coal for the latter would necessitate contracting with mine operators for the opening of new mines. Rather than commit itself to the purchase of high-cost, low-sulfur coals for periods as long as 20 or 30 years, the company prefers to postpone such commitments in the belief that commercially feasible stack-control devices will be available within a period of five years. These are expected to reduce stack emissions of sulfur dioxide substantially below what is achievable simply by the burning of one percent sulfur coal. Data is presented to counter a current report indicating that emissions from the suburban stations contribute to the buildup of atmospheric sulfur dioxide concentrations in the city of Washington.
APTIC-22806

### SYSTEMS STUDY OF AIR POLLUTION FROM MUNICIPAL INCINERATION. VOLUME III. (BIBLIOGRAPHY).

For primary bibliographic entry see Field 01.
APTIC-22808

### PROCESSES FOR RECOVERING SULFUR FROM SECONDARY SOURCE MATERIALS.

Bureau of Mines Information Circ., no. 8076, 62p., 1962. 561 refs.
B. K. Shibler, and M. W. Hovey.
Identifiers: *Hydrogen sulfide, *Manganese dioxide (japanese), Stack gases, Coke, Natural gas, Steam plants, Mining, Paper manufacturing, Petroleum production, Primary metallurgical processing, Alkaline additives, Manganese dioxide japanese, Sulfuric acid, Ammonium compounds, Calcium sulfates, Sulfates.

A bibliography of articles relating to sulfur recovery methods is presented. In addition to general information on sulfur, the material on processing methods is arranged under the six principal sources of secondary sulfur, as follows: volcanic sulfur, including all elemental sulfur deposits not adaptable to the Frasch mining process; hydrogen sulfide as found in sour natural gases, petroleum refinery products, and coke-oven gases; sulfur dioxide from the roasting and smelting of metal sulfide ores and from power plant waste gases; pyrite and pyrrhotite obtained by mining mineral deposits or produced as by-products from the concentration of sulfide ore; gypsum and anhydrite occurring as deposits of calcium sulfate; and industrial wastes containing sulfates, sulfites, and sulfuric acid, such as those produced in the steel, paper, and petroleum industries. Hydrogen sulfide can be utilized for acid making and for conversion to elemental sulfur. Recovery processes for sulfur dioxide include the manganese dioxide and the ammonium sulfate methods. Sulfur from petroleum refining acid wastes can be obtained by regeneration, compounding, or coking processes. (Author summary modified)
APTIC-22809

### SYSTEMS STUDY OF AIR POLLUTION FROM MUNICIPAL INCINERATION. VOLUME II. (APPENDICES).

Little (Arthur D.) Inc., Cambridge, Mass., NAPCA Contract CPA-22-69-23, 312p., March 1970. 39 refs. CFSTI: PB 192379
Steven H. Chansky, Anne N. Dimitriou, Edwin L. Field, Charles R. LaMantia, and Robert E. Zinn.
Identifiers: *Incineration, *Control methods, *Trends, Costs, Questionnaires, Urban areas, Stack gases, Odors, Particulates, Soot, Smokes, Solid waste disposal, Operating variables, Stacks, Emission inventories, Electrostatic precipitators, By-product recovery, Design criteria, Gases.

Volume II of a three volume report presents, largely in tabular and graphic format, data pertinent to a systems study of air pollution from municipal incineration. The scope, conclusions, and recommendations are contained in Volume I; Volume III consists of a comprehensive bibliography. The cost of reducing solid waste to a workable size; processes, physics, and costs of reducing flue gas temperatures for compatability with air pollution control equipment; the stoichiometry of refuse incineration; operating experience on European electrostatic precipitators; by-product recovery, including paper, metal, and heat; composition of refuse; and the projected composition and quantities through the year 2000 are presented. A detailed description is provided of the incineration process from collection to disposition of residue, with consideration being given to equipment options; air pollution via odors, smoke, particulates, and gases; process control; waste water disposal; site requirements; buildings; and utilities. A specimen questionnaire is included that was used to obtain data from the industry on incinerator inventories, capacities, current design trends, and operating practices. Data obtained through the use of this questionnaire are presented and analyzed. The causes and extent of air pollution problems associated with municipal incineration are defined, and a data bank of incinerator emission data is presented. Causes and cures for incinerator deficiencies are discussed.
APTIC-22860

### SYSTEMS STUDY OF NITROGEN OXIDE CONTROL METHODS FOR STATIONARY SOURCES. FINAL REPORT. VOLUME II.

Esso Research and Engineering Co., Linden, N. J., Government Research Lab., NAPCA Contract PH-22-68-55, E.R.E.C. Rept. GR-2-NOS-69, 601p., Nov. 20, 1969. 747 refs. CFSTI: PB 192789
W. Bartok, A. R. Crawford, A. R. Cunningham, H. J. Hall, and E. H. Manny.
Identifiers: *Control methods, *Nitrogen oxides, Proposals, Research programs, Stack gases, Particulates, Fuels, Industrial emission sources, Steam plants, Process modification, Sulfur oxides control, Mathematical modeling, Combustion.

The findings and conclusions of a systems study of nitrogen oxide control methods for stationary sources are reported. The study characterized the nature and magnitude of the stationary NOx emission problem for the U. S., assessed existing and potential control technology on the basis of nationwide cost-effectiveness, and recommended a comprehensive 5-year R&D program on stationary NOx control. Stationary sources account for 55-60% of the total NOx emissions in the U. S. between now and the year 2000, estimated on an uncontrolled basis. Fossil fuel sources will be responsible for over 90% of stationary NOx emissions. Non-combustion sources, e.g., nitric acid plants are important only from the standpoint of local health hazards and aesthetic problems. Available technology is not well developed for controlling stationary NOx emissions. Of the potential control techniques assessed, combustion modifications show the most promise because of their relative simplicity and projected low cost. Requirements for the development of a mathematical model predicting the fate of NOx in combustion processes were defined and a first-generating model was formulated in this study. Combustion flue gas treatment techniques may have to be developed to control NOx emissions from large, coal fired electric power plants, since suitable combustion modification techniques may not be feasible for this category of emission sources. Such treatment may also control sulfur oxide and particulate emissions. Technology is available for controlling emissions from plants manufacturing or using nitric acid, but case-by-case economic and engineering evaluations are required to select the most appropriate techniques. The 5-year R&D plan recommendations are based on the cost-effectiveness of developing stationary NOx emission control technology and on the knowledge gaps identified in this systems study.

These recommendations consist of basic and applied program items, which involve combustion processes, flue gas treatment processes, non-combustion processes, and the required support studies. The program items are grouped in priority blocks, based on their potential impact on stationary NOx emission levels in the U. S. Complete details of the NOx systems study are presented in Volume II of this report.
APTIC-22861

### SYSTEMS STUDY OF AIR POLLUTION FROM MUNICIPAL INCINERATION. VOLUME I.

Little (Arthur D.) Inc., Cambridge, Mass.,
NAPCA Contract CPA-22-69-23, 599p., March 1970. 75 refs. CFSTI: PB 192378
Steven H. Chansky, Anne N. Dimitriou, Edwin L. Field, Charles R. LaMantia, and Robert E. Zinn.
Identifiers: *Incineration, *Control methods, Proposals, Research programs, Costs, Operating criteria, Governments, Emission standards, Urban areas, Settling particles, Suspended particulates, Operating variables, Baffles, Centrifugal separators, Settling chambers, Electrostatic precipitators, Bag filters, Scrubbers, Overfire air, Underfire air, Hydrochloric acid, Carbon monoxide, Nitrogen oxides, Sulfur oxides, Pyrolysis, Gases.

A number of actions are described, both in terms of equipment modifications and operating practices, that can be taken to reduce air pollution emissions, while moving to the objective of improved techniques for the disposal of solid waste by incineration. The following nine recommendations are made: 1) Cooperation, cost sharing, joint funding, and other collective means should be exploited through all levels of the public and private sectors to encourage and hasten the development and implementation of low-pollution incinerator systems. 2) Because a mere 5 to 8% cost factor differentiates incinerator systems with token APC devices compared from those with a first-class APC system, additional funding to meet the latter objective should be seriously considered by agencies now contemplating construction of new facilities. 3) Since the particulate control efficiency (52% average) of the APC systems of plants built in the 1963-1968 period will not be acceptable in the future, the APC performance targets for new plants must be raised to reverse current air pollution trends. A control level of 90% would essentially curtail the rapid increase in total emission in spite of the anticipated four-fold increase in the quantity of refuse incinerated. If the effluent quality of existing plants is improved simultaneously, the total annual particulate emission rate could approach a minimum value by the year 2000. 4) Federal and state sponsorship of programs to demonstrate the performance advantages and possibilities of air pollution control based on new concepts and techniques should be encouraged. 5) Better mixing techniques must be adopted and incorporated in incinerator systems to reduce or eliminate combustible pollutant emission. 6) Undergrate air flow should be reduced to the lowest levels possible and controlled to lessen particulate liftoff consistent with burning rate and grate protection considerations. 7) In view of the proven efficiency of filter bags as APC devices, more advanced experimentation and testing should be considered. 8) Advanced technology concepts should be given due consideration. Of the three described; slagging, fluidized bed, and pyrolysis, the latter deserves prompt attention because it can effect substantial reductions in combustible emissions and flue gas volume. 9) In view of projected increases in hydrogen chloride emissions from incinerators, consideration should be given by both private and public sectors to seek methods to minimize increases in the use of halogenated polymeric materials.
APTIC-22862

### DEVELOPMENT OF A MOLTEN CARBONATE PROCESS FOR REMOVAL OF SULFUR DIOXIDE FROM POWER PLANT STACK GASES. PART VI. SMALL PILOT PLANT AND COMPONENT TEST LOOP DESIGN.

Contract PH 86-67-128, PR-2, AI-70-10, 36p., 1970. CFSTI: PB 191962
Personal Author Not Recorded.
Identifiers: *Pilot plants, *So2 removal (combustion products), *Design criteria, Costs, Stack gases, Steam plants, Operating variables, Scrubbers, Sulfur oxides control, Data analysis, Carbonates.

Conceptual designs and cost estimates are given for two test systems, a Small Pilot Plant (SPP) and a Component Test Loop (CTL), which are part of the development program for the Molten Carbonate Process of sulfur oxides control. The SPP will be operated to test and evaluate the performance of the chemical reactors and to demonstrate process feasibility on an integrated basis under realistic plant operating conditions and on a continuous basis. Secondary objectives will be to study the effects of operational variation on plant performance and of trace impurities on process chemistry. Results will be used to develop specifications and operating criteria for a demonstration plant. The CTL will be operated to test equipment designed and supplied commercially (wherever possible) of a size comparable to those anticipated for the large pilot plant (a molten carbonate plant integrated into a 60-100 Mwe coal-fired unit). For both units, systems design, components, and layout are described and diagrammed in detail. Cost estimates cover only engineering and construction costs.
APTIC-22868

### DEVELOPMENT OF A MOLTEN CARBONATE PROCESS FOR REMOVAL OF SULFUR DIOXIDE FROM POWER PLANT STACK GASES. PART VII. PLANT ANALYSIS.

Contract PH 86-67-128, PR-2, AI-70-11, 58p., 1970. 3 refs. CFSTI: PB 191963
Personal Author Not Recorded.
Identifiers: *Operating variables, *Pilot plants, *So2 removal (combustion products), Costs, Stack gases, Fly ash, Steam plants, Sulfur oxides control, Scrubbers, Carbonates, Reduction.

Design, process description, integration with existing facilities, and capital and operating cost estimates are given for two installations to test the Molten Carbonate Process of power plant sulfur oxides control. The first is a large pilot plant to be integrated with one of the existing 60 Mwe generating units at the Watts Bar Station of TVA, at a total estimated cost of $3.2 million. The second is a prototype full size plant (800 Mwe), with a capital requirement of $11.6 million and an annual operating cost of about $3.9 million. Using hydrogen as the reducing agent, the overall system costs are estimated at 0.62 mils/kwh, not including any credit for sulfur. If fluidized coke were used as the reducing agent, the cost could be reduced to 0.42 mils/kwh. Detailed plant analysis studies are reported on integration considerations, comparative studies on the reduction step and fly ash removal, and on molten carbonate recovery. Unless nearly all of the fly ash is removed from the gas stream before it enters the scrubber, the carbonate melt must be recovered from the melt-ash filter cake for economic operation. (Author summary modified)
APTIC-22869

### DEVELOPMENT OF A MOLTEN CARBONATE PROCESS FOR REMOVAL OF SULFUR DIOXIDE FROM POWER PLANT STACK GASES. PART V. FLY ASH STUDIES.

Contract PH 86-67-128, AI-70-9, PR-2, 30p., 1970. 4 refs. CFSTI: PB 191961
Personal Author Not Recorded.
Identifiers: *Carbonates, *Fly ash, *Filters, Stack gases, Coal, Steam plants, Sintering, Chemical composition, Particle size, Scrubbers, Sulfur oxides control, So2 removal (combustion products), Liquids, Density, Permeability.

Investigations are reported on the physical properties of fly ash (particle size distribution, chemical composition, density, porosity, and solubility), and on methods for filtering the ash from suspension in molten salts to permit recycling of the salts as part of a process in which they are used to remove sulfur dioxide and fly ash from flue gases. Fly ash particle density was close to that of the molten eutectic of lithium, sodium, and potassium carbonates. Mean particle densities were measured at 2.06, 2.11, and 1.96 cm/cu cm for three different coal fly ashes; bulk densities are also given. Fly ash porosity is about 50% for dry coal ash, 90% for fry oil soot, and 67% for salt-saturated coal ash. Sulfuric acid was a stronger leaching agent of coal fly ash than water. Coal fly ash is very sparingly soluble in the carbonate eutectic melt. Filtration studies indicated that almost all of the resistance to flow through the filter was due to the fly ash cake. A 10-micron filter removed virtually all the fly ash in suspension, with no more than 30 m suspended ash found in the filtrate. The sintered-metal medium is adequate for filtering fly ash particles from suspension in M2C03. Efficiency of filteration increased by accumulation on the filter, while at constant pressure, the flow rate decreased with ash accumulation. (Author summary modified)
APTIC-22871

### PARTIAL PRESSURES OF SULPHUR DIOXIDE OVER SOLUTIONS OF SULPHUR DIOXIDE IN MIXTURES OF WATER AND VARIOUS ALIPHATIC AMINES.

Bureau of Mines, Washington, D. C.,
Metallurgical Div., Rept. of Investigation 3415, 45p., Oct. 1938. 37 refs.
A. H. Roberson, and G. W. Marks.
Identifiers: *Absorption (general), *Amines, Primary metallurgical processing, Density, Temperature, Vapor pressure.

Since monoethanol amine, diethylene triamine, and triethylene tetramine appear to be promising absorbents for sulfur dioxide, experiments were performed to establish the physical properties of their aqueous solutions, containing varying amounts of SO2. Recovery of SO2 after it has been absorbed by an amine solution depends largely on the partial pressure of the gas over the absorbing solution. As frictional losses in pipelines depend, in part, on the viscosities of the fluids employed, viscosities relative to water at 20 C of the 9.75, 18.01, 26.72, and 37.82% aqueous solutions of diethylene triamine were determined both before and after saturation with SO2. Densities of all the solutions used were measured over a temperature range of 25-85 C, and at the following percentages of SO2 saturation: 0, 25, 50, 60, 75, 90, and 100. The marked volume change, which varies depending on the amine and its concentration and accompanies the saturation of aqueous amine solutions with SO2, was also measured. A method is provided for the precipitation of amine sulfate and the regeneration of diethylene triamine when this compound is used in the absorption of SO2 from smelter smoke. To obtain some information concerning the quantities of SO2 that can be removed under controlled conditions from aqueous diethylene triamine solutions saturated with this gas, two series of experiments were performed. The concentration of amine, water, and sulfur dioxide in solutions partly saturated with SO2 was also determined. Effective capacities of various absorbing agents for SO2 were compared, and a review of recent writings and patents was compiled.
APTIC-22876

### FOREIGN LITERATURE DIGEST.

Chem. Ind. (New York), 48 (4):433, 514, April 1941.
T. E. R. Singer.
Identifiers: *Manganese dioxide (japanese), *Absorption (general), Ussr, Electric power production, By-product recovery, So2 removal (combustion products), Magnesium compounds, Oxides.

An article in an Indian chemistry journal is summarized in which work done by several U.S.S.R. organizations on the elimination and use of sulfur dioxide from smoke gases is reported. The article gives a detailed discussion of two methods. The first entails absorption of SO2 in magnesium oxide, resulting in a reusable magnesium sulfite. It is practical for large power stations located near some contact sulfuric acid plant. The second entails acidification of SO3 in solution under the catalytic influence of metallic ions, in which the conventional MnSO4 is replaced by pyrolusite, containing Mn02, which is relatively inexpensive and does not poison the catalyst. Gas purification is completed with the lime method to produce a stronger acid (18-20%) than the 10-13% acid produced with the use of MnO2. With this acid-catalytic method, SO2 concentrations do not reach levels injurious to workers or the surrounding country, there are no dust processes; the quantity of waste products and waste water is small; and the process is extremely simple and easily regulated. Several commercial uses for the weak-acid end product are noted.
APTIC-22883

### EXPERIMENTS WITH PILOT BALLOON SOUNDINGS AT SOME POWER STATION SITES.

For primary bibliographic entry see Field 05.
APTIC-22884

### HUMIDITY EFFECTS ON ENGINE NITRIC OXIDE EMISSIONS AT STEADY-STATE CONDITIONS.

For primary bibliographic entry see Field 01.
APTIC-22888

### RECOVERY OF LEAD AND SULFUR FROM GALENA CONCENTRATE, USING A FERRIC SULFATE LEACH.

Bureau of Mines, Washington, D. C., Rept. of
Investigations 7360, 13p., March 1970. 10 refs.
CFSTI: PB 190968
F. P. Haver, K. Uchida, and M. M. Wong.
Identifiers: *Oxidation, *By-product recovery, *So2 removal (combustion products), Lead, Stack gases, Primary metallurgical processing, Ammonium compounds, Iron compounds, Sulfur compounds, Sulfates, Electrolysis.

As part of a program to study methods of recovering elemental sulfur from the processing of sulfide ores for both anti-pollution and economic by-product purposes, a procedure is described for recovering lead and sulfur from galena flotation concentrate. The method consists of aqueous oxidation of the concentrate, using ferric sulfate to convert lead sulfide to sulfate and to give elemental sulfur; regeneration of the ferric sulfate by electrolysis in a diaphragm cell; treatment of the leach residue with ammonium carbonate solution to change the lead to an acid-soluble form and to produce ammonium sulfate as a by-product; solution of the lead carbonate in hydrofluosilicic acid followed by electrolysis to recover the lead as metal and regenerate the acid for further use; and extraction of the elemental sulfur from the final residue with an organic solvent. About 90% of the lead can be recovered by the above method as 99.9-%-pure metal, together with two-thirds of the sulfur, half in the elemental form and half as ammonium sulfate. (Author abstract modified)
APTIC-22889

### AIRCRAFT ENGINE EXHAUST EMISSIONS.

For primary bibliographic entry see Field 01.
APTIC-22890

### OXIDES OF NITROGEN FROM SMALLER GASOLINE ENGINE.

Preprint, Society of Automotive Engineers, Inc.,
New York, 15p., 1970. 12 refs. (Presented at the
Automotive Engineering Congress, Detroit,
Mich., Jan. 12-16, 1970, Paper 700145.)
Kiyoshi Matsumoto, Tadahide Toda, and
Hidetaka Nohira.
Identifiers: *Operating variables, *Automotive emission control, *Nitric oxide (no), Japan, Engine exhausts, Gasolines, Internal combustion engines, Engine operation modification, Air-fuel ratio, Spark timing, Hydrocarbons, Carbon dioxide, Carbon monoxide, Nitrogen oxides.

Experiments on nitric oxide emission from smaller gasoline engines were conducted on 65.6, 113.4, and 115.8 cu in., 4 cylinder in-line water cooled gasoline engines, using nondispersive infrared gas analyzers to measure carbon monoxide, carbon dioxide, hydrocarbon (as n-hexane), and NO. Engine size had little effect on the level of NO concentration, but NO formation is closely related to all engine operating variables that influence combustion peak temperature, duration of peak temperature, and excess oxygen. Experiments to determine influence of air/fuel ratio, spark timing, manifold pressure, coolant temperature, compression ratio, and engine speed showed that air/fuel ratio and spark timing have the largest effect on NO emission. A richer mixture and retarded spark timing reduce nitrogen oxide emissions but increase fuel consumption and emissions of other pollutants. An exhaust gas recycling method is effective but results in impaired engine and vehicle performance. It is concluded that to reduce nitrogen oxides, some sacrifice of engine performance, such as fuel economy and increase of CO emission, will be inevitable. At present, reducing NOx by spark timing control is considered the most practical method of meeting the new California standard for 1971 cars, but much further research is needed; the development of a highly reactive exhaust reactor is recommended. (Author conclusions modified)
APTIC-23354

### DETERMINATION OF COLLECTION EFFICIENCY OF FIBER FILTERS FOR VERY SMALL PARTICLES.

(Determination du rendement de collection des
filtres a fibres pour des particules ultra-fines).
Text in French. Health Phys., 11 (1):15-20, Jan.
1965. 7 refs.
Jacques Fontan, Daniel Blanc, and Andre
Bouville.
Identifiers: *Efficiency, *Particle size, *Filters, France, Aerosols, Diffusion, Brownian movement, Radioactive radiation.

Installations with possible emission of radioactive aerosols require the use of fiber filters. The collection efficiency depends on the diameter of the aerosols. Collection takes place through a process of mechanical filtering. The phenomenon takes place with particles of diameter above 1 micron. Minimum filtrations takes place with particles of .2 micron. For diameters below this figure, the Brownian movement increases the probability of aerosol trapping in the fibers. A device was built where aerosols of 15 A are generated through disintegration of radon and thoron, radioactive gases naturally present in the air. The Schneider-Poelman filter was used. Three sub-types of this filter exist according to mutual percentage of materials employed: alfa fibers and asbestos fibers. The filter was placed physically at the end of the device producing small aerosols. Activities alpha and beta were measured using scintillation probes. The efficiency of collection was tabulated for each of the filter subtypes. Spectrometry was conducted on the filter for each of the three types in order to accurately measure absorption. The efficiency of collection increases as the aerosol dimensions decreases; this is in accord with filtration theory. In the case of small aerosols, filtration is governed by diffusion and the efficiency is independent of the speed of the air stream through the filter.
APTIC-23355

### REMOVAL OF SUSPENDED MATTER FROM INDUSTRIAL GASES.

J. Inst. Fuel (London), 11 (60):514-527, Aug. 1938.
(Presented at the Institute of Fuel Meeting,
London, April 28, 1938.)
Robert Rogers Harmon.
Identifiers: *Dusts, *Impingers, *Spray towers, *Condensation, Stack gases, Fumes, Blast furnaces, Scrubbers, Water.

Initial attempts to clean dust-laden gases by spraying water into gas mains have resulted in a variety of means, each based on a single principle or combination of principles, for removing solids from industrial gases. These methods are settling, centrifugal force, impingement, filtration, scrubbing, electrical precipitation, and condensation. A new system, the Peabody process, combines scrubbing, condensation, and impingement. The system intensively scrubs gases by the action of hot-water sprays while the gases are at a temperature above their theoretical dew point. The sensible heat of the gases is simultaneously transformed into latent heat by evaporation of the maximum amount of water. This is accomplished by recirculating hot water through primary stages of the scrubber, a procedure that permits ample time for complete humidification and prevents condensation of water vapor during the two operations. The latent heat is extracted by means of cooling water, and condensation of water vapor takes place in stages. With condensation of vapor on the dust particles, the droplets formed grow to a size sufficient only for removal. Thus, in each cooling stage, a certain quantity of dust particles are removed before condensation takes place. This prevents any unnecessary condensation of vapor on any one class of particles. Perforated impingement plates are provided for trapping small particles. Application of the system to blast furnace gas, chemical fumes, and flue gases is discussed.
APTIC-23357

### APPARATUS FOR RECOVERING SULFUR FROM SULFUR-BEARING GASES.

(Du Pont de Nemours (E. I.) Powder Co.,
Wilmington, Del.) U. S. Pat. 945,112. 3p., Jan. 4,
1910. (Appl. June 10, 1908, 3 claims).
Paul S. Smith.
Identifiers: *By-product recovery, *Vapor recovery systems, *So2 removal (combustion products), Combustion gases, Design criteria, Sulfur compounds, Reduction, Combustion, Steam.

A previous invention provided for the recovery of sulfur from sulfur dioxide by the reaction of the latter with water gas heated by the combustion of producer gas. Although comparatively efficient, the process had the disadvantage that the water gas and the producer gas had to be alternately formed and separately stored before passage to a reducer. The drop in the temperature of each gas caused by storage required an expenditure of a certain amount of storage to elevate the temperatures to those necessary for combustion and reaction. The present invention permits the continuous manufacture of both gases, dispenses with their storage, and thus allows the recovery process to be carried on with maximum efficiency and economy. The producer gas is formed by an air blast supplied to fuel in the gas generator. The gas is passed to the lower part of the retort, ignited by an auxiliary blast of air, and so caused to circulate upward through the retort. Water gas is formed by passing steam through the bed of incandescent fuel in the generator, and the gas mixed with sulfur dioxide supplied by pipe means. The mixed gases are passed to the upper part of the retort from which they circulate downward to contact the red hot brick-work heated by the upward passage of the burning produce gas. The sulfur vapor formed by this contact is condensed first to a liquid and then solid flowers of sulfur.
APTIC-23358

### HIGH-TEMPERATURE COMBUSTION OF COAL SEEDED WITH POTASSIUM CAR-

### BONATE IN THE MHD GENERATION OF ELECTRIC POWER.

Bureau of Mines, Washington, D. C., Rept. of Investigations 7361, 33p., March 1970. 19 refs.
CFSTI: PB 190969
D. Bienstock, R. J. Demski, and R. C. Kurtzrock.
Identifiers: *Magnetohydrodynamics (mhd), *Coal preparation, *Combustion, Corrosion, Combustion gases, Stack gases, Fly ash, Coal, Electric power production, Centrifugal separators, Control methods, Combustion air, Carbonates, Potassium compounds, Nitrates, Nitric oxide (no), Temperature.

Open-cycle magnetohydrodynamic (MHD) elecprical power generation may play an important role in meeting the demand for electrical energy because of its high thermal efficiency and its ability to reduce materially both air and thermal pollution. In this technique, electricity is generated by the movement of ionized, high-velocity gases through a magnetic field. For central-power station generation, these gases would be produced by the high-temperature combustion of fossil fuels to which an easily ionizable material is added. In the experiments described, pulverized coal was mixed with potassium carbonate in concentrations up to 1.23 g-moles/kg coal. Combustion air was enriched with oxygen; coal, seed, and primary air was passed to cyclone burners. Hot combustion gases from the burner were then directed through a brick-lined furnace to a corrosion test tower, where samples of boiler-tube construction materials were maintained at wall temperatures of 800-1500 F and exposed to combustion effluent of 1800-2500 F. After cooling, the gases were passed to a cyclone dust collector. Practically complete removal of sulfur dioxide was achieved with the seed addition. Nitric oxide formation followed theoretical expectations at combustion temperatures; some decomposition of NO occurred during gas cooling. Nitrates in the fly ash were less than 1.7% of total fixed nitrogen. With aqueous extraction of the fly ash, a maximum recovery of 75% of the potassium was obtained. Haynes 25 boiler tubes showed no corrosion at wall temperatures of 1500 F in 2500 F seeded flue gas. The stainless steels 310, 316, and 446 were resistant at a metal temperature of 1100 F in gas at 2100 F, but carbon steel and Croloy 5 were attacked at 800 F wall temperature and 1800 F flue gas temperature.
APTIC-23359

### THE TECHNOLOGY OF COMBUSTION AND ENVIRONMENTAL PROTECTION.

(Forbranningsteknologi och miljovard). Text in Swedish. 48p., 1970. 10 refs.
R. Collin.
Identifiers: *Combustion, *Excess air, *So2 removal (combustion products), Sweden, Stack gases, Soot, Nitrogen oxides, Sulfur trioxide, Temperature.

The emission of soot, sulfur oxides, and nitrogen oxides can be reduced through detailed technical knowledge. Under certain conditions, combustion can be increased and soot formation can be decreased. A very effective supply of oxygen is required for efficient combustion. Soot formation factors are very low at temperatures over 1000 C. Excess oxygen can increase the formation of sulfur trioxide. The presence of SO3 increases the formation of soot. Some investigations show a 50% reduction in soot after switching to natural low-sulfur oil. Oxides of nitrogen can be reduced by using excess oxygen and lower temperatures. Theoretically, the SO3 emission can be reduced to a very small amount if soot and excess oxygen can be eliminated.
APTIC-23361

### ANNUAL REPORT ON THE STATE OF AIR POLLUTION CONTROL (SERIES 5).

(Jahresuebersicht Reinhaltung der Luft (5. Folge). Text in German. Giesserei (Duesseldorf), 56 (12):372-377, June 5, 1969. 88 refs.
Ekkehard Weber.
Identifiers: *Industrial emission sources, *Measurement methods, *Control equipment, Legislation, Regulations, Cements, Steel, Germany, Mineral processing, Primary metallurgical processing, Air quality measurements, Dust fall, Collectors, Centrifugal separators, Electrostatic precipitators, Bag filters, Sulfur oxides control, Carbon monoxide, Sulfur dioxide.

A survey is given of literature covering a vast scope of air pollution problems, including legislation, governmental regulations, measurement of the content of sulfur dioxide, carbon monoxide dust fall, etc. in various parts of Germany, France, Italy, and other countries. The emissions of dust and gases from various industries are discussed, including the types of equipment used for their control, such as dry and wet processes, electrostatic filters, and bag filters. Measuring techniques are also reviewed.
APTIC-23364

### ADSORPTION OF SO2 BY CARBON ADSORBENT (II). CATALYTIC OXIDATION OF SO2 ON THE SURFACE OF ACTIVATED CHARCOAL.

(Tansokei kyuchakuzai no SO2 kyuchaku (dia 2-ho). Kasseitan hyomen ni okeru SO2 no sessyoku sanka hanno). Hitachi Manufacturing Co. (Japan), Central Inst., p. 1419, 1968 (*). Translated from Japanese. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 2p., Oct. 27, 1969.
Kyoko Yamamoto, and Michiharu Seki.
Identifiers: *Catalytic oxidation, *Adsorption (general), Carbon black, Japan, Stack gases, So2 removal (combustion products), Reaction kinetics.

Measurements of the state of adsorption of sulfur dioxide on activated charcoal demonstrated the partial existence of physical adsorption when SO2 was adsorbed at 100 C with water and oxygen. Most of the adsorbed SO2 was extracted (above 180 C) as SO4 (-2) with water, the remainder with H202. Since the same results were obtained with charcoal samples that adsorbed H2S04 directly, SO2 appears to exist as SO[illegible] H2S04 on the surface of charcoal. Sulfur dioxide with 02 and H20 had a greater tendency to be adsorbed as H2S04 than did SO2 with 02 alone or H20 alone, and the speed of the reaction was faster. The implication of this finding for adsorption of SO2 in exhaust gas is noted.
APTIC-23368

### AUTOMOTIVE AIR POLLUTION CONTROL.

Preprint, Society of Automotive Engineers, Inc., New York, 9p., 1970. (Presented at Society of Automotive Engineering Section Meeting, 1970, Paper 700248.)
Harry F. Barr.
Identifiers: *Automotive emission control, Toxic tolerances, Headache, Automotive emissions, Engine exhausts, Crankcase emissions, Fuel tank evaporation, Carburetor evaporation losses, Smog, Power sources, Internal combustion engines, Atutomotive emission control, Maintenance, Hydrocarbons, Photochemical reactions, Carbon monoxide.

A general outline of the air pollution problem in the United States is presented, with particular emphasis on the contributions made by the internal combustion engine, and reductions obtained in hydrocarbon and carbon monoxide emissions by recent control systems are indicated. Los Angeles, photochemical smog, and emission control for California cars are mentioned in particular. Emissions and their control are indicated in relation to the four emission sources: crankcase, carburetor, fuel tank vent, and exhaust pipe. Ninety-three percent of the national carbon monoxide total is automotive, and 51% of the total air pollution tonnage in the U. S. is carbon monoxide. Health effects set in around 100 ppm where headache and reduced mental acuity occur after several hours of exposure. Alternate powerplants and periodic vehicle maintenance are mentioned, as well as the contribution of the Society of Automotive Engineers to emissions control.
APTIC-23369

### FLUORINE EMISSION AT ALUMINIUM WORKS.

Chem. Engr. (London), 46 (7):266-268, Sept. 1968.
B. Boehlen.
Identifiers: *Aluminum, *Primary metallurgical processing, *Control methods, *Fluorine compounds, Costs, Dusts, Furnaces, Collectors, Centrifugal separators, Electrostatic precipitators, Scrubbers, Ventilation, Hydrofluoric acid, Electrolysis.

The electrolysis of fused alumina, with cryolite as the fluxing agent and electrolyte, gives rise to waste gases with a fluorine content. The method by which the electrolysis furnaces operate requires two separate waste-gas purification systems, one for interception and conveyance of waste furnace gases to a purification plant, and one for cleaning fluorine-contaminated air used for ventilation of furnace room premises. The purification processes for both systems are described briefly, and the problems are reviewed. Because of the large quantities of waste air involved, considerable costs are incurred to provide the power required for ventilation, the large quantities of scrubbing water, and the pumps to convey the water; the presence of corrosive hydrogen fluoride creates added difficulties. The possibility of replacing cryolite by electrolytes which do not contain fluorine is recommended for future research.
APTIC-23370

### ELIMINATION OF MALODOROUS EMISSIONS IN THE CHEMICAL INDUSTRY.

Chem. Engr. (London), 46 (7):268-270, Sept. 1968.
Hans Bretscher.
Identifiers: *Chemical processing, *Odor counteraction, Stacks, Gas chromatography, Odorimetry, Afterburners, Electrostatic precipitators, Filters, Scrubbers, Control methods, Absorption, Process modification, Dispersion, Meteorology.

Meteorological conditions are an important factor in the emission of odorous pollutants, for example in the frequency of unpleasant odors during the night. The best method available at present for analyzing odors is gas chromatography, particularly for odors from traces of organic compounds. Measures for control of malodorous emissions in the chemical industry fall into three groups: (1) prevention of waste-gas components at their origin by plant and process design and/or modification; (2) a variety of suitable processes for purifying waste gases; and (3) dilution in the atmosphere from stacks. Since purification methods cannot yet provide complete removal of odorous components, they must be combined with stack expulsion for adequate dispersion. Effective organizational administration is essential to the success of any control program. Areas recommended for intensive future work are meteorology (tracer methods to rapidly gain regional information, and improved wind gauges), improved and lower-cost gas chromatography analyzers, and process-engineering measures to eliminate 'olfactorily intensive' substances.
APTIC-23371

### EMISSIONS AND ABATEMENT OF OXIDES OF NITROGEN IN NITRIC ACID MANUFACTURE.

Chem. Engr. (London), 46 (7):263-266, Sept. 1968.
W. Teske.
Identifiers: *Chemical processing, *Control methods, *Nitric oxide (no), Germany, Stack gases, Absorption, Nitric acid, Catalysts, Reduction.

The 12 nitric acid factories of West Germany, producing acid mainly for use in fertilizers, emit a

total of about 100 tons/day of nitric oxide. Stack gases have a brown color, due to a visibility limit of 200 ppm NO. New plant construction is of the pressure type, in which the NO content of the stack gases is about half that of older plants. The NO content of these gases is due to the incomplete conversion, or the absorption yield, of NO to nitric acid. Thus, to eliminate the NO in the waste gases, the absorption yield must be increased or the NO destroyed. Various absorption processes are briefly reviewed in terms of possibilities for accelerating absorption, but total absorption in an acid system is not practical. Catalytic reduction processes reduce nitrogen oxides by means of hydrogen, hydrocarbon gases, or ammonia, and can be carried out in two stages: partial reduction of the NO2 to NO (decoloring the waste gases), and total reduction of NO and NO2 to N2. Because the price of the reducing agent is a decisive factor, an attempt should be made to decompose the nitrogen oxides directly, which would permit general adoption of catalytic purification by the nitric acid industry.
APTIC-23372

### REPORT ON METHODS FOR THE REMOVAL OF SULPHUR DIOXIDE FROM FLUE GASES.

Chem. Engr. (London), 46 (7):262-263, Sept. 1968.
4 refs.
W. Leithe.
Identifiers: *So2 removal (combustion products), Costs, Stack gases, Steam plants, Stacks, Absorption (general), Alkalized alumina (adsorption), Manganese dioxide (japanese), Reinluft process (adsorption)

A wet absorption process for purifying exhaust gases from sulfuric acid production by washing with ammonium sulfite-bisulfite solution at pH of 6 is briefly noted, and the most important and promising dry absorption processes for flue gas desulfurization are summarized (Reinluft, Sulfacid, Aluminate, catalytic H2SO4, and Mitsubishi) in table form. The economics of full-scale applications from pilot plant results are difficult to evaluate, but a rise of power generation costs of 10-25% has to be expected. At present, no process being studied for the removal of sulfur dioxide from flue gases is developed to the point where it can be recommended as technically satisfactory and economically feasible, and high stacks are still the only means for ground level control. The demand for byproduct sulfur is expected to rise and give impetus to further process development.
APTIC-23373

### DEVELOPMENT OF A MOLTEN CARBONATE PROCESS FOR REMOVAL OF SULFUR DIOXIDE FROM POWER PLANT STACK GASES. PART I. PROCESS CHEMISTRY-REDUCTION.

Contract PH 86-67-128, N.A.R.C. Rept. AI-70-5, PR-2, 103p., 1968. 48 refs. CFSTI: PB 191957
Personal Author Not Recorded.
Identifiers: *So2 removal (combustion products), *Carbonates, *Reduction, Combustion gases, Coke, Steam plants, Scrubbers, By-product recovery, Hydrogen, Iron compounds, Carbon monoxide, Sulfates, Sulfides, Sulfites, Catalytic activity, Reaction kinetics, Reaction mechanisms, Pressure, Temperature.

In the Molten Carbonate Process, the flue gases are scrubbed with a melt of alkali metal carbonates. This produces a melt mixture of alkali metal carbonates, sulfites, and sulfates, which must be treated to regenerate the carbonate and recover the sulfur. The first step of the treatment is the chemical reduction of the sulfite and sulfate to sulfide, using hydrogen, carbon monoxide, or carbon as the reducing agent. The chemistry of the hydrogen reduction step is studied in detail. The reduction is zero-order with respect to sulfate concentration, and the rate is catalyzed by iron, and autocatalyzed by the sulfide product. Increasing the temperature 100 C quadruples the reaction rate if no iron catalyst is present, and doubles the iron-catalyzed rate. Concerning the reduction reaction mechanism, the reaction does not take place in the gas phase; sulfate and sulfide combine to form the intermediate that undergoes reduction in the rate determining step; and the role of iron is one of either stabilizing the reactive intermediate (thus increasing its concentration) and/or acting directly in the reduction of the intermediate. Studies with carbon monoxide indicate it is not as reactive as hydrogen. However, its reactivity increases with pressure more rapidly than hydrogen, so it may be useful at high pressures. At temperatures above 700 C, carbon is an excellent reducing agent. At 800 C, complete reduction is obtained in 14 minutes using fluidized petroleum coke and an iron catalyst. (Author abstract modified)
APTIC-23374

### DEVELOPMENT OF A MOLTEN CARBONATE PROCESS FOR REMOVAL OF SULFUR DIOXIDE FROM POWER PLANT STACK GASES. PART III. MATERIALS STUDY.

For primary bibliographic entry see Field 09.
APTIC-23376

### RECOVERY OF SULPHUR FROM SMELTER GASES BY THE ORKLA PROCESS AT RIO TINTO.

Trans. Inst. Mining Met., vol. 58:427-516, 1949. 8 refs.
H. R. Potts, and E. G. Lawford.
Identifiers: *Orkla process, *Primary metallurgical processing, *By-product recovery, Copper, Combustion gases, So2 removal (combustion products), Arsenic compounds, Oxidation, Reduction, Temperature.

A process which recovers sulfur from copper-smelting fumes is described. The process operates by containing the sulfur dioxide produced in the combustion of the ore in a closed furnace, thus preventing the SO2 from being burned itself in atmospheric air. Then, the SO2 is sent through a column of solid carbon, where a reduction reaction separates the sulfur out as a vapor. Upon cooling, the crude solid sulfur can be removed. The process as described is used at the Rio Tinto mine in Brazil, but it originated at the Orkla Co. in Norway, where it got its name. The Rio Tinto plant operation is described in detail. Catalysts are not used because the ore contains substantial amounts of arsenic, which greatly complicates catalytic activity. Improvements needed in the process include better oxidation of the ore and greater reduction of SO2, possibly by going to higher operating temperatures.
APTIC-23378

### 'FROHOLE' NEARS COMPLETION.

Gas Age, vol. 130, 131:22-25, Dec. 1964.
Personal Author Not Recorded.
Identifiers: *Compressed gases, *Storage facilities, *Natural gas, Concrete, Steel, Soils, Topographic interactions, Compression, Freezing.

A frozen earth gas storage plant under construction near Carstadt, N. J. is described. The reservoir, which is the first of its type in the U. S., will handle two hundred million cu ft of gas per day when completed. The geology and high water table of the area had to be overcome before a permanent installation could be considered. The earth surrounding the area of the hole is frozen by sinking cooling pipes 45 ft down and 10 ft out from the edge of the hole. After the hole is excavated, a concrete ring is placed at ground level to protect the hole and to help support the 140 ton steel dome. The liquefaction process, boil-off facilities, and horsepower requirements of the plant are described. The winter operation of the plant involves sending out gas, and during this period, liquefaction operations cease. Flow diagrams of the system are given.
APTIC-23381

### PROCESS FOR OBTAINING ELEMENTAL SULFUR FROM SULFUR DIOXIDE OR GASES CONTAINING IT.

(Verfahren zur Gewinnung von elementarem Schwefel aus Schwefeldioxyd oder solches enthaltenden Gasen). Text in German. (Metallgesellschaft A. G., Frankfurt (W. Germany)) Ger. Pat. 711,509. 4p., Oct. 2, 1941. (Appl. March 24, 1938, 4 claims).
Conway Frhr. V. Girsewald, Gerhard Roesner, and Max Wohlwill.
Identifiers: *By-product recovery, *So2 removal (combustion products), Germany, Ashes, Combustion gases, Fly ash, Organic sulfur compounds, Carbon dioxide, Carbon monoxide, Sulfur compounds, Nydrogen sulfide, Catalysts, Reduction.

A process is presented for aftertreatment of sulfur dioxide containing carbon monoxide, carbon oxysulfide, and hydrogen sulfide as impurities, in the presence of a catalyst at 400-800 C to obtain a product that contains only carbon dioxide, water vapor, and sulfur vapor. The aftertreatment is accomplished by recycling the waste gas from the reduction furnace into a chamber connected with the furnace, in which the only catalyst present is fly ash or ashes in the form of granules or briquettes; the walls of this chamber also are built of materials that will have little or no catalytic effect.
APTIC-23385

### CONVERSION OF SULFUR DIOXIDE CONTAINED IN GASES IN SMALL AMOUNTS TO SULFUR.

(Umstzung von Schwefeldioxyd in dieses in geringer Menge enthaltenden Gasen in Schwefel). Text in German. (Metallgesellschaft A. G., Frankfurt (W. Germany) Ger. Pat. 594,464. 5p., March 1, 1934. (Appl. March 18, 1932, 5 claims).
Conway Frhr. V. Girsewald, and Hans Weidmann.
Identifiers: *By-product recovery, *Absorption (general), *Reduction, Germany, Combustion gases, Coke, Scrubbers, So2 removal (combustion products), Carbonyls, Sulfides, Catalysts, Temperature.

A fuel-saving process absorbs sulfur dioxide from roasting gas in water at normal temperature and pressure in a washing tower, expels the SO2 subsequently by air and or combustion gas at 60 C, and reduces the gas mixture at 1100 C in a reduction furnace by coke to sulfur which is separated. The initial absorption enriches the gas from the original 5-6 to 10-15 volume %. The mixture leaving the washers should contain 10-15 volume % oxygen in order to maintain the subsequent reduction at 1000-1100 C, which is a self sustaining reaction. Gas leaving the reduction furnace is used, together with air, for the expulsion of the absorbed SO2. The gas leaving the reduction furnace contains, aside from vaporized sulfur, 2% and 1.2-.5% carbonyl sulfide SO2. Following precipitation of the S, the waste gas is further desulfurized at 650-700 C in an oven filled with bauxite. The entire process converts about 90% of the SO2 to elementary sulfur.
APTIC-23396

### NEW TYPE OF OIL FIRING SYSTEM FOR LIME SHAFT KILNS.

(Neuartige Oelfeuerungen fuer Kalkschachtoefen). Text in German. Zement-Kalk-Gips (Wiesbaden), 57 (11):470-472, Nov. 1968. 4 refs.
E. Stingel.
Identifiers: *Fuel oils, *Lime, *Firing methods, Germany, Gasification (synthesis), Combustion.

An oil-fired lime shaft kiln is described in which combustion and gasification of the oil take place in combustion clambers. Due to gas feedback and a combustion chamber air ratio of 0.5, the refractory lining is unaffected by operating temperatures. The kiln combines trouble-free operation with the production of a uniformly burnt lime of the highest reactivity.
APTIC-23397

### SMELTER FUME CONTROL.

Air Pollution and Smoke Prevention Assoc. of
America, Inc., Pittsburgh, Pa., Proc. Air Pollution
Smoke Prevention Assoc. Am. Annu. Conv., 44th,
Roanoke, Va., 1951, p. 105-107.
J. Paul Jenny.
Identifiers: *Fumes, *Electrostatic precipitators, *Scrubbers, Costs, Primary metallurgical processing.

The 1948 Los Angeles Country Air Pollution Code prohibited fume emissions as dark or darker than No. 2 Ringelmann from a single source for periods of more than three minutes. To comply with the Code, one smelter first conducted intensive investigations of sources of fume generation and their control. It was found that fume control equipment would not be necessary for furnace stacks if furnace operators were properly instructed in firing methods and the amount of flux to be added. A fume collection device was desirable for the skim treatment unit, a source of noticeable amounts of fume. The choice of equipment was narrowed down to an electrostatic precipitator or an ultrasonic agglomerator. Installed costs of fume control equipment were estimated to be $47,500 for the ultrasonic unit and $38,500 for an electrostatic precipitator. The ultrasonic unit was specified to have capacity of 5000 cfm and the electrostatic precipitator a capacity of 10,000 cfm, which would provide better ventilation and reduce inlet grain loading to conditions more favorable to the unit. The unit selected was a combination scrubber-electrostatic precipitator built principally of redwood with wrought iron discharge electrodes and transite collecting electrodes. The unit has one 10 KVA transformer designed for 75,000 volts maximum. Tests show that the unit will operate within the limits of the Code.
APTIC-23404

### ULTRAFILTER MEMBRANES AND ULTRAFILTRATION.

Chem. Rev., 18 (3): 373-455, 1936. 296 refs.
John Douglass Ferry.
Identifiers: *Membrane filters, *Colloids, *Permeability, Particle size, Calibration methods, Diffusion, Fluid flow, Pressure.

An ultrafilter is defined as a filter whose pores or interstices are of colloidal or molecular dimensions; filtration through it, ordinarily with the purpose of complete or partial retention of the colloidal or molecular species present in the disperse system filtered, is termed ultrafiltration. The study of ultrafiltration has always been closely associated with that of dialysis and, to a lesser extent, osmosis and the problem of the semi-permeable membrane. Dialysis is a differential diffusion, employing a membrane impermeable to the colloidal solutes but permeable to the crystalloidal. If the membrane is impermeable to all solutes, so that the only diffusion occurring is that of water into the solution, the process is ordinary osmosis. At osmotic equilibrium, the solution is under a hydrostatic pressure which causes sufficient flow out of the solution to balance the molecular diffusion of water into it. If the hydrostatic pressure is increased beyond the osmotic pressure, there is a net flow of water out of the solution compartment, with a concentration of the solute, and the phenomenon is ultrafiltration. Similarly, in dialysis under pressure, if the pressure is increased so that both water and diffusible solutes flow out of the solution, ultrafiltration is taking place. Methods of preparing ultrafilter membranes, of grading porosities, and of calibrating membranes are reviewed. Discussion of the theoretical and experimental study of the mechanism involved in ultrafiltration is presented, and some applications of ultrafiltration are considered. Applications include the fractionation and study of the composition of disperse systems, and the estimation of particle sizes in disperse systems, both chemical and biological.
APTIC-23413

### AN EVALUATION OF COAL CLEANING PROCESSES AND TECHNIQUES FOR REMOVING PYRITIC SULFUR FROM FINE COAL. (INTERIM REPORT).

NAPCA Contract PH-86-67-139, BCR Rept. L-339, Sept. 1969. CFSTI: PB-193486
Personal Author Not Recorded.
Identifiers: *Coal preparation, Coal characteristics, Pulverized fuels, Scrubbers, Sulfur compounds.

Coal cleaning methods and techniques for removing pyritic sulfur from the fine-sized coal were evaluated and washability data was extended for finer sizes of coal. The work was divided into three phases. Phase I was a comprehensive evaluation of the pyrite liberation and removal characteristics of U. S. utility coals when pulverized. The seventy coals tested came from three geographical areas: Western Pennsylvania, Eastern Ohio, and Illinois. Maximum pyritic sulfur reduction obtained at the 30 mesh by 0 size was 93.7% with an Ohio No. 6 coal; the minimum pyritic sulfur reduction obtained was 51.2% with an Illinois No. 6 coal. At the p.c. grind, 95.0% of the pyritic sulfur was removable from a Pennsylvania Lower Freeport coal while the minimum percentage of pyritic sulfur removal was 54.5% with a Pennsylvania Middle Kittanning coal which had a very low R.O.M. Pyritic sulfur content. Total sulfur reductions covered a much wider range, since the percentage of organic sulfur, which was not removable, quite significartly affected the percent reduction. Phase II of the program consisted of a performance evaluation of three existing coal cleaning or mineral preparation devices. Six coals were selected on the basis of Phase I evaluations. The concentrating table, the concentrating spiral, and the compound water cyclone were the three commercially available units tested in Phase II. The results of the coal cleaning tests with the concentrating table were, in general, excellent. The total sulfur content of the clean coal obtained from the table tests with the three Pennsylvania coals and one of the Ohio coals correlated very well with the Phase I float-sink test results. A significant lack of correlation in the Phase I and Phase II reults was noted in the chemical composition of the 1.60 float fraction of two additional Ohio coals. The results obtained with the compound water cyclone and concentrating spiral were not encouraging; these two units did little in further reducing the sulfur content in the 30 mesh coal. Phase III of the program was a selective evaluation of 10 of the coals tested under Phase I to determine their selective evaluation of 10 of the coals tested under Phase I to determine their suitability for pyrite reduction by the conceptual process of pyritic removal at the utility pulverizer. A wide range in sulfur reduction was obtained in the Majac air classification tests. Additional tests of this type are not recommended at this time. Total sulfur reductions of 40% could be significant if the cost of the process per ton of coal is low. If this should prove to be the case, numerous additional Phase III evaluations should be made.
APTIC-23423

### COLLECTION EFFICIENCY OF AEROSOL PARTICLES AND RESISTANCE TO FLOW THROUGH FIBER MATS.

J. Appl. Phys., 27 (2):161-169, Feb. 1956. 19 refs.
J. B. Wong, W. E. Ranz, and H. F. Johnstone.
Identifiers: *Efficiency, *Aerosols, *Filter fabrics, Particulates, Operating variables, Particle size, Glass fabrics, Flow rates.

Theoretical equations in the literature for collection efficiency and pressure drop of fiber mats are analyzed in detail in terms of the impaction efficiency and drag coefficient of single fibers. These equations are evaluated by comparing the apparent fiber efficiency and drag with theoretical values. The collection efficiencies for sulfuric acid aerosols of 0.4- to 1.3-micron particle diameter, and the resistance to flow through glass fiber mats composed of 3.5-, 6.2-, and 9.6-micron fibers, were investigated experimentally using a condensation aerosol generator. The results agree with the theory that particle collection in this range is function of the inertia of the particles, the interception by the fibers, and the nature of the flow around the fibers, respectively, and that the pressure drop is a function of the flow characteristics and the fiber interference effect. The experimental data indicate a critical value of the inertial parameter below which inertial impaction ceases to be important, though the exact value is difficult to determine. (Author abstract modified)
APTIC-23428

### FUME PROBLEMS AND CONTROL IN ALUMINUM MELTING OPERATIONS.

Manufacturing Chemists Association,
Washington, D. C., Air Pollution Abatement
Committee and Manufacturing Chemists
Association, Washington, D. C., Water Pollution
Abatement Committee, Proc. Mfg. Chem. Ass.
1952-53 Pollution Abatement Conf., 15p.
Roy E. Paine, A. E. Huotari, and Paul D. Hess.
Identifiers: *Primary metallurgical processing, *Electrostatic precipitators, *Scrubbers, Aluminum, Fumes, Pilot plants, Baffles, Aluminum compounds.

A series of pilot-plant tests were carried out to obtain information enabling the design of suitable control equipment for emissions from the reclamation of metallic aluminum from furnace skimmings. The type of equipment finally selected was a combination scrubber-electrostatic precipitator. The preliminary wet scrubbing collects large particles and soluble gases and by humidification conditions the gas for efficient electrostatic precipitation of the smaller particles. Variations in air flow experiences after installation of the scrubber were eliminated by means of baffles. The average efficiency of the unit is 97%.
APTIC-23429

### PROCESS OF TREATING WASTE GAS CONTAINING SULFUR OXIDE.

(Mitsubishi Shipbuilding and Engineering Co.,
Ltd., Tokyo (Japan)) U. S. Pat. 3,226,192. 6p.,
Dec. 28, 1965. 5 refs. (Appl. Feb. 25, 1963, 10
claims.)
Masumi Atsukawa, Kazuhiro Matsumoto, and
Hiroyuki Murokawa.
Identifiers: *By-product recovery, *Manganese dioxide (japanese), Japan, Combustion gases, Operating variables, Sulfuric acid, Chlorine compounds.

A process is described for treating a waste gas containing sulfur oxide with a manganese oxide absorbent to render the waste gas harmless, as well as producing commercially valuable sulfuric acid and chlorine from such a waste gas with manganese oxide regenerated. Water is added to manganese oxide to form an aqueous suspension with a concentration sufficient to maintain the fluidity of the suspension. This aqueous suspension is contacted with a waste gas containing sulfur oxide to absorb and remove it from the gas. Manganese sulfate produced in the absorption step is reacted with hydrogen chloride in liquid phase at a preferable reaction temperature of 30 C to produce sulfuric acid while depositing manganous chloride in a crystalline form. Then, the manganous chloride thus deposited is oxidized and decomposed in the presence of air at a temperature from 500-900 C to be converted into manganese oxide and also to produce chlorine.
APTIC-23433

### EXPERIENCE IN COMBUSTION OF HEAVY OIL WITH LOW SULFUR CONTENT.

(Erfarenheter vid eldning med lagsvavlig
tjockolja). Text in Swedish. Konf. Energi Och
Miljo. Kungalv, Sweden, 1969, no. 4:1-5, 1969.
O. Wikstrom.
Identifiers: *Sulfur compounds, *Costs, *Fuel oils, Corrosion, Sweden, Particulates, Boilers, Combustion.

Advantages from burning natural low-sulfur oil include better combustion, lower consumption, and less boiler corrosion; disadvantages include higher cost and a higher pure point. The investment costs for a boiler with a running time of 300 hr/year and an annual repayment of 9% with a depreciation period of 10 years are one Swedish kronor (20 cents) per cu m. The profit, according to higher effect, is between 0.5 -1.0 Swedish kronor /cu m. From environmental aspects, the natural low-sulfur oil is preferable not only because of lower sulfur content but also because of lower particulate emissions.
APTIC-23443

### ON THE ADHESION OF DROPS AND PARTICLES ON IMPACT AT SOLID SURFACES. I.

J. Colloid Sci., vol. 10:266-280, 1955. 13 refs.
T. Gillespie.
Identifiers: *Deposition, *Aerosols, *Filters, Surface coatings, Great britain, Droplets, Particle shape, Particle size, Flow rates, Electric charge, Surface properties.

The process of adherence by aerosols to filter surfaces is investigated by exposing the surface of a thin cylinder to a low-velocity aerosol stream and measuring particle deposition. The presence of electric charges on the particles enhances their chances of adhering. Coating of the surface may affect the chances of specific particles' adhering to it. The discrepancy between actual filter performance and theoretical performance may be explained by taking into account the possibility that not all the particles which graze the surface of the filter fibers adhere. Nonadherence on impact appears to be limited to a range of particle velocity and to depend upon the physical properties of the particle as well as the collecting surface. (Author summary modified)
APTIC-23445

### RECOVERY OF AMMONIUM SULPHATE FROM SULFUR DIOXIDE IN HOT FLUE GASES (XI). WIDE RANGE APPLICABILITY OF DIFFERENT CONCENTRATIONS OF SO2 AND H2O.

(Ryuan nado o fukusei suru Endohaigasu no jyogaibo (XI). SO2, H2O nodokohani ryoiki ni okeru tekiyo ni tsuite). Tokyo Inst. of Tech. (Japan), p. 1424, 1968 (*). Translated from Japanese. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 2p., Oct. 27, 1969.
Raisaku Kiyoura, Haruo Kuronuma, Yoshisuke Uenishi, Terunori Hayashi, and Nobuyuki Yamaguchi.
Identifiers: *Operating variables, *So2 removal (combustion products), Japan, Stack gases, Coal, Natural gas, Fuel oils, Petroleum refining, By-product recovery, Ammonium compounds, Sulfates, Water.

The Kiyoura-T.I.T. process for removing sulfur dioxide from flue gas was studied for the effects of variations of SO2 and water concentration on the final by-product, ammonium sulfate. Increasing H2O from 10 to 20 vol% had no effect, while increasing SO2 from 0.1 to 2.0 vol% resulted in an exothermic increase during formation of ammonium sulfate. The results, which are graphically illustrated, demonstrate the applicability of the process for flue gases from oil combustion, coal combustion, petrochemical factories, chemical industries, and natural gas industries.
APTIC-23447

### FOOD INDUSTRY-VENTILATION FOR MACHINES.

(Livsmedelsindustri-ventilation for maskiner). Text in Swedish. VVS (J. Assoc. Heating, Ventilation, Sanit. Engrs.) (Stockholm), 61 (1):20-25, Jan. 1970.
Hans Olsson.
Identifiers: *Food and feed operations, *Odor counteraction, *Ventilation, Sweden, Odors, Absorption, Adsorption Chemical reactions, Combustion.

Air pollution is mainly a problem of odors in the food industry. Compared with other gaseous pollutants, odors are a difficult technical problem. There are different methods to reduce the concentration of odors, such as ventilation, adsorption, absorption, chemical reaction, and combustion. To choose the right air cleaning equipement is difficult. It seems that good processing and acceptable localizing are as effective as any air cleaning equipment.
APTIC-23456

### SOLID STATE REVERSIBLE REACTIONS OF SQUARE PLANAR D TO THE 8TH POWER COMPLEXES WITH SULFUR DIOXIDE.

For primary bibliographic entry see Field 06.
APTIC-23471

### ACTIVATED ADSORPTION OF SULFUR DIOXIDE, OXYGEN, AND MIXTURES THEREOF, OVER VANADIUM OXIDE.

(Adsorbimento attivato di anidride solforosa, ossigeno e loro miscele su ossido di vanadio). Text in Italian. Gaz. Chim. Ital., vol. 77:66-75, 1947. 4 refs.
Nino Agliardi, and Taddeo Slodyk.
Identifiers: *Adsorption (general), *Oxygen, *Catalysts, Italy, Combustion gases, Vanadium compounds, Oxides, Sulfur trioxide, Temperature.

Adsorption of sulfur dioxide, oxygen, and their mixtures was studied over a silica gel catalyst containing 5% vanadium pentoxide. The catalyst was saturated with SO2 in less than 100 hours, which was in contrast to some earlier experiments with the adsorption of hydrogen over zinc oxide. The adsorption takes place within the temperature range of 290-480 C. Given equal conditions of temperature and pressure, SO2 adsorption is about five times that of atmospheric oxygen, and takes place more rapidly. Air is adsorbed more rapidly and in larger quantities onto a catalyst saturated with SO2 than SO2 is adsorbed onto a catalyst saturated with air, under analogous conditions. For air-SO2 mixtures, variations of pressure on the order of 10% do not especially affect adsorption. It is of the same order of magnitude, although slower at the beginning, as the apparent adsorption that one observes when the gases are treated separately. This apparent adsorption of the mixture is greater than that which corresponds to the total adsorption of sulfur dioxide that is stoichiometrically capable of being formed. The same degree of contraction is noted as when only SO2 is adsorbed. From this, one can derive the difference in active centers of adsorption for SO2 and for SO3. The activation energy for SO2 adsorption is about 13500 calories per second per cu cm.
APTIC-23475

### COMBUSTION OF PHOSPHORUS WITH SIMULTANEOUS RECLAMATION OF SULFUR.

(Verbrennung von Phosphor unter gleichzeitiger Gewinnung von Schwefel). Text in German. (Farbenindustrie (I. G.) A.-G., Frankfurt, Germany) Ger. Pat. 556,160. 2p., July 14, 1932. (Appl. March 15, 1931, 3 claims).
Robert Suchy, and Oswald Goehring.
Identifiers: *By-product recovery, *Catalytic oxidation, *So2 removal (combustion products), Germany, Combustion gases, Phosphorus compounds, Phosphates, Sulfates, Sulfides, Catalysts, Reduction, Pressure, Temperature.

Without a catalyst, phosphorus does not react with sulfur dioxide, even at temperatures up to 300 C and pressures of 100 atm. Therefore, a process combining the combustion of phosphorus with reclamation of sulfur is proposed which works with roasting gas with even a low SO2 concentration, a combustion temperature of 700 C, and a catalyst in the form of sodium sulfate, sodium phosphate, or potassium metaphosphate. A heated reaction chamber filled with ceramic shards impregnated with the catalyst is filled with phosphorus vapors and with roasting gas. After it reaches 700 C, the activated catalyst induces a reaction which yields P205 and S. Separation is accomplished with water or by melting the sulfur.
APTIC-23477

### PREPARATION OF ELEMENTARY SULFUR FROM HYDROGEN SULFIDE AND SULFUR DIOXIDE.

(Herstellung von elementarem Schwefel durch Reaktion zwischen Schwefelwasserstoff und Schwefeldioxyd). Text in German. (Bolidens Gruvaktiebolag, Stockholm (Sweden)) Ger. Pat. 721,053. 2p., April 23, 1942. (Appl. Nov. 26, 1938, 1 claim).
Rudolf Lindblad, and Fritz Olov Herneryd.
Identifiers: *By-product recovery, *So2 removal (combustion products), *Catalysts, *Reduction, Cements, Sweden, Combustion gases, Iron compounds, Sulfides, Hydrogen sulfide, Oxidation.

The equilibrium of the reaction of hydrogen sulfide with sulfur dioxide favors the formation of sulfur at lower temperatures. A method is therefore proposed which brings about the reaction of the 2 gases at between 200 and 350 C in the presence of a catalyst consisting of a mixture of gypsum or of Portland cement with pyrite. Best results were obtained with a 50/50 mixture of both components: the conversion was almost complete, and the consistency of the catalyst was good. Both these characteristics suffer if the pyrite component of the catalyst falls below 10% or rises above 80% of the mixture. Pyrite by itself will not catalyze the reaction adequately; 5-10% of the starting gas remains unconverted.
APTIC-23478

### REDUCTION OF SULFUR DIOXIDE USING REDUCED ALUNITE AS CATALYST.

(Vosstanovleniye sernistogo gaza s primeneniem vosstanovlennogo alunita v kachestve ktatlizator). Text in Russian. Azerb. Khim. Zh., no. 2:104-109, 1965. 4 refs.
G. B. Shakhtakhtinskiy, and A. I. Guliev.
Identifiers: *So2 removal (combustion products), *Catalysts, *Reduction, Ussr, Combustion gases, Aluminum compounds, Potassium compounds, Sulfates, Flow rates, Temperature.

Hydrogen reduction of sulfur dioxide over reduced alunite catalyst was studied experimentally at temperatures of 500-900 C and flow rates up to 137 ml/min. At temperatures of 660-850 C, the sulfur yield using alunite reached nearly 100% as compared to about 85-90% using bauxite under the same conditions. Increasing the quantity of catalyst used from 0.5 to 2 g gave an initial sharp increase in sulfur yield which then gradually reached 100% for alunite, and 98% at 800 C.
APTIC-23480

### PARTICULAR DEDUSTING PROBLEMS IN REFUSE INCINERATION PLANTS.

(Besonderheiten bei der Entstaubung in Muellverbrennungsanlagen). Text in German. Mitt. Ver. Grosskesselbesitzer, 48 (2):118-126, April 1968. 6 refs. (Presented at the 'Refuse Incineration' Sessions of the VGB, held Feb. 9, 1968 at Hamburg; Feb. 16, 1968, at Munich; and Feb. 23, 1968, at Duesseldorf.)
H. Brandt, and H. Heer.
Identifiers: *Dusts, *Incineration, *Control equipment, Germany, Operating variables, Collectors, Centrifugal separators, Electrostatic precipitators, Scrubbers, Temperature.

The possibilities of using various dust removal systems for the purification of waste gases from incinerator plants are discussed in the light of standards set by governmental regulations. The incineration system is affected by the type of construction, i.e., the presence or absence of heat utilization and whether waste gases are cooled with cold air or with a water spray. Consideration

is given to such operational problems as the retention of paper fly ash and the burning of auto tires. Structural requirements are examined, and observations under actual operation are reported. Illustrative material gives some indication of the appearance and size of such plants. Exhaust gases, as they leave the incinerator, are at a temperature of 800-1200 C. Mechanical dust separators using special sensitive materials can withstand a temperature of 750 C, those using insensitive materials can withstand 480 C, and electrostatic filters made of conventional materials can resist temperatures up to 400 C. In providing the means for cooling these gases, an additional safety margin of 50 degrees should be allowed. Cooling can be achieved by cooling the surface of the channels through which the gases pass, by the use of a water spray which absorbs vaporization heat as it turns to steam, or by mixing cold air with the gases. Among the types of dust removal equipment examined are mechanical devices, scrubbers, and electrostatic filters.
APTIC-23482

### METHOD OF NATURAL GAS (CH4) LIQUEFACTION.

(Verfahren zur Erdgas (CH4)-Verfluessigung).
Text in German. Linde Ber. Tech. Wiss., no. 18:4-6, 1964. 1 ref.
Rudolf Becker.
Identifiers: *Methanes, *Compression, Germany, Natural gas, Gas turbines, Design criteria, Heat transfer, Compressed gases, Pressure, Temperature.

The theoretical reversible process of methane liquefaction by its isothermal compression followed by adiabatic expansion is considered, and conditions for optimum practical realization of the process are investigated. A simple model is suggested consisting of a compressor, where CH4 is compressed; a heat exchanger, where CH4 is then cooled down; and a turbine, where part of the CH4 expands while the other part, after further cooling, expands in the throttle of the liquid collector. Energy consumption in this process decreases rapidly with an increase in pressure. An improved process is suggested in which highly compressed CH4, instead of being cooled in coolers, is expanded in two parallel working turbines, one working at environmental temperature, another at lower temperature. Energy curves for processes with partial precooling in one and two turbines were calculated, which lead minima at 20 atm. Introduction of a second turbine lowered energy consumption by 10%. The optimum of the process was .47 kWh per normal cubic meter of liquid CH4. The suggested process is characterized by low energy consumption, simple machine design, small heating surfaces, low pressure changes, and simple operating techniques.
APTIC-23486

### THE NEW WAY OF LIFE: THE FOUNDRYMAN AND CLEAN AIR.

For primary bibliographic entry see Field 12.
APTIC-23489

### MECHANICS OF AIR CLEANING.

Trans. ASAE (Am. Soc. Agr. Engrs.), 8 (3):342-344, 351, 352, 1965. 7 refs. (Paper No. 64-437.)
K. T. Whitby, and D. A. Lundgren.
Identifiers: *Filters, *Design criteria, Operating variables, Particle size, Mathematical analyses, Diffusion, Brownian movement, Electrical properties, Surface properties.

The principal air-cleaning mechanisms are reviewed, and the best working equations for calculating the contributions of the various mechanisms are presented. Design of a filter for adequate life is done empirically, the expected filter life then being a function of the aerosol concentration and characteristics as well as the filter design. For most roughing filters, the life is limited by surface area and roughness and not by media thickness; for medium or higher performance filters, the life is determined primarily by total media area, with filter surface roughness and thickness having a minor effect. Efficiency of a filter mat is calculated from the collection efficiency of the fibers comprising that mat. Single-fiber collection efficiency is defined as the ratio of the area cleared of particles by the fiber to the fiber projected area in the direction of flow. Brownian diffusion, interception, inertial impaction, and electrical attraction contribute to the collection of particles. Filter mat fractional efficiency is defined as the efficiency of removal of a single size of particle by the filter mat, and overall collection efficiency for any filter is a function of both filter fractional efficiency and size distribution of the airborne particulate matter entering the filter. Roughing filters, medium performance filters, high performance filters, and absolute type filters are discussed. Theoretical collection efficiency is based on partical re-entrainment, filter fiber diameter, filter uniformity, additive forces, and particle shape. Another important filter parameter which can be obtained by calculation is pressure drop-solidarity factor relationship.
APTIC-23492

### AIR PURIFICATION IN A ROLLING MILL.

(Umluftreinigung in Walzbetrieben). Text in German. Wasser Luft Betrieb, 12 (2):70-72, Feb. 1968.
Hans-Joachim Ochs.
Identifiers: *Metal fabricating and finishing, *Operating variables, *Electrostatic precipitators, Germany, Odors, Dusts, Mists, Odor counteraction, Flow rates, Emulsions, Temperature.

Practical experience with various types of air filtering systems indicates that the electrostatic filter is to date the only type capable of handling the dust problems in a rolling mill. A detailed description is given of an electrostatic air filter operating on the Penney principle. According to tests conducted by the US National Bureau of Standards, when the airflow velocity through the filter is 1.7 meters per second, the electrostatic filter removes at least 90% of the dust. If the velocity is slowed to less than 2 m/sec, the separating efficiency approaches 100%. The operating temperature should not exceed 60 C. The electrostatic filter offers the additional advantage of removing many unpleasant odors, by virtue of the fact that much of the odoriferous material is bound to liquid particles suspended in the air. The ozone created by the electrical discharges also provides a means of oxidizing undesirable gaseous components in the air. The principal impurity to be removed from air aspirated from above a cold-rolling mill is an oil mist, while in the case of a hot mill the chief product is an oil-water emulsion. The normal airflow velocity from an operating mill is 1.7 m/sec., whereas the use of the electrostatic filter requires a rate of flow not exceeding 1.3 m/sec; the ideal rate is 1.0 m/sec., or 60% of the rate corresponding to maximum operating efficiency. The specific problems relating to the removal of oil mists and oil-water emulsions are discussed, together with some brief comments on the economics of the filtering system.
APTIC-23493

### SYNCHROTHERMAL REACTOR SYSTEM FOR CONTROL OF AUTOMOTIVE EXHAUST EMISSIONS.

Preprint, Society of Automotive Engineers, Inc., New York, 10p., 1970. 12 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 12-16, 1970, Paper 700147.)
W. Glass, D. S. Kim, and B. J. Kraus.
Identifiers: *Exhaust manifold reactors, *Engine exhausts, Automotive emission control, Engine operation modification, Air-fuel ratio, Dynamometers, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Temperature.

To demonstrate the feasibility of simultaneous significant reduction in automotive emissions of carbon monoxide, hydrocarbons, and nitrogen oxide an experimental system with very low exhaust emission levels was developed, based on thermal exhaust manifold reactors. Rich fuel-air mixtures were used to decrease nitrogen oxides, which were further decreased by recirculation of a controlled amount of exhaust gas under selected operating conditions. Injections of air synchronized with individual exhaust valve opening promoted more complete combustion of hydrocabons and CO. Acceptable reactor temperatures under high-speed operation were maintained by diverting some of the injected air to the intake manifold. Muffler back pressure and a fixed recycle line proportioned the exhaust recycle which was injected between the carburetor venturi and the throttle plate. Recycle flow was blocked off during idle, wide open throttle, and choked operation. Composite exhaust emission levels below 0.3% CO, 10 ppm unburned hydrocarbons, and 150 ppm nitrogen oxides were obtained by the federal test procedure. Fuel consumption data indicating a fuel penalty of 16% were obtained from extended dynamometer runs. No attempts at obtaining system or component life data were made in these initial studies. The overall cost of such a system is likely to be high because of the need for high-temperature materials and higher fuel consumption. (Author abstract modified)
APTIC-23496

### CHRYSLER EVAPORATION CONTROL SYSTEM. THE VAPOR SAVER FOR 1970.

Preprint, Society of Automotive Engineers, Inc., New York, 13p., 1970. 7 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 12-16, 1970, Paper 700150.)
J. O. Sarto, W. S. Fagley, and W. A. Hunter.
Identifiers: *Fuel evaporation, *Vapor recovery systems, *Automotive emission control, Fuel tank evaporation, Carburetor evaporation losses, Hot soak, Hydrocarbons, Carbon monoxide.

The development of a system, already in production, for controlling automotive evaporation losses of hydrocarbons from fuel tank vents and carburetors at a level of 6 gm or less when using a prescribed diurnal and 'hot soak' test cycle is described. The system operates on the basic principle of the displacement of air from the engine crankcase by the gasoline vapors during storage, and the combustion of the gasoline vapors in the cylinders during subsequent engine and vehicle operation. Displacement takes place because the gasoline vapor has approximately twice the density of air. Evaporation losses from both the carburetor and fuel tank are conducted to the engine crankcase for storage while the engine is shut down. Hydrocarbon emissions into the atmosphere from fuel evaporation were reduced by about 90%. Despite exhaust emission interaction (the system increased hydrocarbons 0.01 gm/mi and carbon monoxide 0.5 gm/mi), emissions of hydrocarbons and CO are still successfully maintained at low levels. Of particular interest in the no-moving-parts system are its reliability, durability, and vapor-liquid separator 'standpipe.'
APTIC-23497

### THE PREPARATION OF SULFUR.

(Gewinnung von Schwefel). Text in German.
(United Verde Copper Co., Clarkdale, Ariz.) Ger. Pat. 562,517. 2p., Oct. 6, 1932. (Appl. Sept. 23, 1930, 1 claim).
Personal Author Not Recorded.
Identifiers: *By-product recovery, *Catalytic oxidation, *So2 removal (combustion products), Combustion gases, Ammonium compounds, Aluminum silicates, Iron compounds, Silicates, Sulfides, Hydrogen sulfide, Catalysts.

Sulfur is obtained by catalytic conversion of hydrogen sulfide and sulfur dioxide; the catalyst is a hydrated aluminum or trivalent iron double silicate with alkali or alkaline earth, especially in the form of natural or artificial zeoliths. This catalyst retains its catalytic power even at a high level of

saturation with sulfur which is an improvement over the catalytic activity of silica gel or of active carbon. An added advantage is that this catalyst works at room temperature and yields 50% more S than silica gel over the same time period. The SO2 can come from roasting gas of pyrites; the H2S, from the dissolution of ferrosulfidic materials in sulfuric acid. The gas mixture should contain H2S and SO2 in a stoichiometric ratio of 2:1. The contact reaction generates enough heat to vaporize the resulting water, the sulfur precipitates in a battery of contact chambers whence it is removed by shutting off 1 chamber at a time without interrupting the operation. Catalyst layers inactivated by sulfur deposition are reclaimed by extraction with ammonium sulfide and subsequent steaming to remove ammonium sulfide residues. Orthodichlorobenzol is an even better solvent. Sulfur can also be removed with superheated steam.
APTIC-23498

### A NEW CONCEPT OF STRATIFIED CHARGE TWO STROKE ENGINE. YUI AND OHNISHI COMBUSTION PROCESS (YOCP).

Preprint, Society of Automotive Engineers, Inc., New York, 12p., 1969. 10 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Chicago, Ill., May 19-23, 1969, Paper 690468.)
Saburo Yui, and Shigeru Ohnishi.
Identifiers: *Stratified charge engines, *Engine design modification, Japan, Engine exhausts, Automotive emission control, Air-fuel ratio, Design criteria, Hydrocarbons, Carbon monoxide, Nitrogen oxides.

Preliminary data are given on an engine system which provides improved performance and control of carbon monoxide, unburned hydrocarbons, and nitrogen oxides without supplementary devices, while maintaining satisfactory fuel consumption without erratic or irregular operation. A scavenging type of 2-stroke gasoline engine was used to attain stratification of charge by direct injection of gasoline into the cylinder. The process was so designed that the charge of air matched the combustion process in order to produce a stable stratified charge consisting of a rich mixture on the circumferential side and a rarefied mixture on the concentric side; thus, it is intended to attain a high air-fuel ratio over a wide range of engine operations. The system demonstrates improved controllability and responsiveness, with no critical interrelationships among fuel components that could cause misfunctioning. Quiet operation is characteristic, together with adequately large power values and no smoke limit to pose opacity problems.
APTIC-23499

### PROCESS OF RECOVERING ELEMENTAL SULFUR FROM SULFUR GASES.

(Assignee not given.) U. S. Pat. 1,182,915. 7p., May 16, 1916. (Appl. June 19, 1915, 4 claims).
William Francis Lamoreaux.
Identifiers: *By-product recovery, *Reduction, *So2 removal (combustion products), Carbon black, Combustion gases, Primary metallurgical processing, Hydrogen, Carbon monoxide, Sulfur compounds, Hydrogen sulfide.

Known methods for recovering sulfur from gases generated by the smelting, roasting, or calcining of pyrite ores and other sulfur-containing materials reduce sulfur dioxide by maintaining it in contact with incandescent carbon for a predetermined time. In the ensuing reaction, the carbon is consumed and must be supplied according to the amount of oxygen present in the sulfur gases treated. Instead of depending on the carbon to supply the reducing agent, the present invention first mixes the sulfur-bearing gases with a reducing agent in a gaseous, vaporized, or atomized state to obtain practically complete reduction of sulfur dioxide and no appreciable consumption of carbon. The bed of incandescent carbon in this case serves to assure intimate contact between the reducing agent and the gas and as a conducting and heating medium when it is necessary to supply an increment of heat in the form of an electric current. Suitable reducing agents are gaseous or vaporous carbon monoxide, hydrogen, hydrogen sulfide, or vapors and liquids of hydrocarbon compounds.
APTIC-23502

### WET-PROCESS REMOVAL OF SULFUR DIOXIDE FROM WASTE GASES.

(Auswaschen von Schwefeldioxyd aus Rauchgasen). Text in German. Chem. Ing. Tech., 37(11):1136-1139, 1965. 5 refs.
R. Germerdonk.
Identifiers: *Absorption (general), Feasibility studies, Germany, Fuel oils, Electric power production, Scrubbers, By-product recovery, So2 removal (combustion products), Design criteria, Sodium hydroxide, Sodium sulfite, Sulfides, Ph.

A study is made of the amount of outlay required for the wet desulfurization of gases and the economic feasibility of such a process. The study utilized waste gases from a power plant fired with fuel oil, the sulfur dioxide content of which required reduction from 5 g/cu m to about 50 mg/cu m. The scrubbing process offers a considerable saving over that of earlier processes, but is very complicated. On the other hand, while providing about 99% reduction of the sulfur content, it generates a minimum of additional waste products. It has been estimated that the heat requirement for driving off SO2 from wash water at atmospheric pressure amounts to about half the heat requirements of the power plant involved. Recent attempts at improvement have aimed at reducing this heat requirement. The SO2-absorbing powers of water is very good for concentrations of less than 0.5 g/cu m of air, but the recovery of SO2 from the water can be expensive. One method of reducing this problem is by the addition of acid to increase the hydrogen ion concentration, which in turn decreases the SO2 solubility, facilitating its recovery. A flow chart is given, illustrating the recommended method of recovery, and equations are derived for calculating the vapor pressure of SO2 on the basis of dissociation factors. The recommended equipment is capable of accomplishing its task with about 10-12 liters of water per cubic meter of waste gas, with a waste gas throughput of 500,000 cubic meters per hour, at a cost of about 10% of the total plant operating cost; the waste water containing about 25 mg per liter of sulfite, and the sodium sulfite content amounts to less than 0.7%. The only chemical additive is sodium hydroxide in quantities of about 2.3% of the quantity required for a complete chemical reaction with all of the SO2 absorbed.
APTIC-23504

### THE PURIFICATION OF COMMERCIAL GASES AT ELEVATED TEMPERATURES.

Am. Gas. Assoc. Proc., 1936:724-756. 92 refs.
Wilbert J. Huff, and Lloyd Logan.
Identifiers: *Absorption, *Catalytic oxidation, *Organic sulfur compounds, *Hydrogen sulfide, Catalysts, Reduction, Gases.

Conventional processes for gas purification have generally involved the reaction of hydrogen sulfide with solids, e.g., iron oxide, and liquids at ordinary temperatures. New processes for eliminating sulfur compounds follow radically different lines, employing elevated temperatures and novel purifying materials. These processes relate chiefly to the elimination of organic sulfur by means of catalysts and to the simultaneous removal of hydrogen sulfide and organic sulfur. Experimental work leading to their development is described in this two-part paper. Work directed toward the conversion of organic sulfur to hydrogen sulfide involved about 200 tests with nearly 100 catalytic mixtures. The most active of these were prepared from uranium oxide in mixture with copper or cerium oxide. By use of such catalysts, conversion was almost quantitative when gas relatively free from tar, dust, and hydrogen sulfide was treated at 300-450 C. The hydrogen sulfide formed is removed from cooled exit gases by any of the usual methods. Work directed toward the simultaneous removal of hydrogen sulfide and organic sulfur centered on a cyclic process involving alternate absorption of sulfur by a purifying material and regeneration of the purifying material by the action of an oxygen-containing gas. In extensive laboratory and plant tests, best results were obtained with mixtures of baked copper-vanadium, clay-copper, and chromium-clay. The commercial practicability of this process for purification of water gas, coal gas, high-sulfur refinery gas, and natural gas is discussed.
APTIC-23507

### FROZEN EARTH LNG STORAGE.

Gas Age, vol. 130:22-28, April 1963.
Personal Author Not Recorded.
Identifiers: *Storage facilities, *Natural gas, *Compressed gases, Costs, Concrete, Steel, Soils, Operating variables, Design criteria, Compression.

Transcontinental Gas Pipe Line Corp. has filed an application to construct an $11.9 million plant which will hold one billion cu ft of natural gas, reduced to 1/600th of its volume by refrigeration at -259 F. The frozen earth container will be a cylindrical hole, approximately 165 ft deep and 115 ft in diameter, surrounded by a concrete wall, with an insulated 9% nickel steel roof. Location of the facility will be in the Hackensack Meadows of New Jersey, and the hole will be excavated in frozen meadowland soil and underlying bedrock. During the liquefaction process, which will utilize a Cascade cycle, gas will be taken from Transco's main pump line at a minimum pressure of 315 psia, measured and then passed through a separator. The gas is then compressed to approximately 660 psia, cooled and then passed through 'purification' equipment to remove inerts and other components in the gas stream which would become solids at LNG temperatures. Discharge stations (turrets) capable of handling large quantities of dry chemical (bicarbonate of soda) will be installed as well as water fog systems and water hydrants. Vaporization facilities will be capable of vaporizing 200,000 Mcf per day. Flow diagrams are included which depict a summer injection day and a winter peak withdrawal day. The various streams of 'flash' and 'boil-off' gases pass through heat exchangers in the liquefaction equipment and help liquefy the incoming stream.
APTIC-23512

### RECOVERY OF AMMONIUM SULFATE FROM SULFUR DIOXIDE IN HOT FLUE GASES. IX. CRYSTAL STRUCTURE OF THE RECOVERED AMMONIUM SULFATE.

(Ryuan nado o fukusei suru Endohaigasu no jyogaiho. (IX). Kiso Gosieho ni yoru Ryuan no Kessyo ni tsuite). Translated from Japanese.
Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 3p., Oct. 28, 1969.
Raisaku Kiyoura, Tsuichi Iwai, Jyoyo Kosaka, Haruo Kuromuma, and Yoshisuke Uenishi.
Identifiers: *Ammonium compounds, *Sulfates, *By-product recovery, *So2 removal (combustion products), Japan, Stack gases, Fertilizer manufacturing, Particle size, Sulfur dioxide, Crystal structure.

Studies on the recovered ammonium sulfate by the Kiyoura-T.I.T. process are made as a comparison among it, a guaranteed reagent, and commercial ammonium sulfate crystals. Samples of crystals formed by recrystallization of the recovered by-product are analyzed by X-ray diffraction meter and electron microscopy. The recovered ammonium sulfate has a purity of 99.6%. Studies of the particle sizes are included. The recovered product is of high quality without much difference in crystal structure between it and the two reagents. The recovered product can be used directly as a fertilizer.
APTIC-23514

### ALKYLATION UNIT YIELDS DUAL BENEFIT.

Chem. Eng., 67 (25):132-135, Dec. 12, 1960.
N. P. Chopey.
Identifiers: *Isobutanes, *Olefins, *Alkylation, *Petroleum refining, Gasolines, Scrubbers, Hydrofluoric acid, Butanes, Hydrogen sulfide, Catalysts, Chemical reactions.

A new 2900-bbl/day hydrofluoride acid-alkylation plant is solving the problem of excess butanes by reacting isobutane with butylenes to produce isooctane for gasoline blending. The facility treats saturated C2-C4 feed from crude distillation and catalytic reforming and olefinic C3-C4 stock from catalytic cracking. The first stream is pretreated in a diethanolamine tower where hydrogen sulfide is removed; the olefin stream undergoes both caustic scrubbing and diethanolamine treatment before alkylation. The alkylation reaction takes place in two shell-and-tube contactors where hydrocarbons and acid are combined by jet mixing. Contactor effluent goes to an acid settler where the reacted hydrocarbon mixture and dissolved acid are withdrawn. The stream then passes to an isostripper for separation of the alkyl product.
APTIC-23519

### ABSORPTION TOWER FOR GASES ESPECIALLY FOR THE PRODUCTION OF SULFITE LIQUOR.

(Absorptionsturm fuer Gase, insbesondere zur Herstellung von Sulfitlauge). Text in German.
(Assignee not given.) Ger. Pat. 484,234. 3p., Sept. 26, 1929. (Appl. Jan. 25, 1928, 1 claim).
Alois Danninger, and A. Porr.
Identifiers: *Design criteria, *Scrubbers, *Absorption (general), Limestone, Europe, Combustion products, Combustion gases, So2 removal (combustion products), Sulfites.

A proposed sulfite liquor tower consists of a tubular flue located within a mantle with an insulating space in between. The flue is made of wood and is resistant only to chemical agents but not to static stresses. The outer mantle is of iron concrete or of shaped brick and is able to withstand static stresses including wind and weather but is not resistant to chemical agents. Flue and mantle thus serve two different purposes, but together they form a unit of superior durability with a flue well insulated against temperature fluctuations with good access for purposes of repairs. Such towers can be joined to form batteries which sit on a common foundation. The flue is filled with limestone which is rinsed with water from a reservoir placed on top of the tower. The sulfur dioxide containing gas enters at the bottom of the tower; the liquor accumulates in a tank at the foot of the tower where impurities settle out, whereupon the liquor is pumped to its destination.
APTIC-23522

### A METHOD FOR THE PREPARATION OF INSOLUBLE SULFUR.

For primary bibliographic entry see Field 06.
APTIC-23523

### DEVELOPMENT OF A MOLTEN CARBONATE PROCESS FOR REMOVAL OF SULFUR DIOXIDE FROM POWER PLANT STACK GASES. PART II. PROCESS CHEMISTRY -REGENERATION.

Contract PH 86-67-128, N.A.R.C. Rept. AI-70-6, PR-2, 152p., 1968. 7 refs. CFSTI: PB 191958
Personal Author Not Recorded.
Identifiers: *Regeneration, *So2 removal (combustion products), *Carbonates, *Hydrogen sulfide, Stack gases, Steam plants, By-product recovery, Calcium compounds, Iron compounds, Carbon dioxide, Catalytic activity, Chemical reactions, Reduction, Water, Vapors, Reaction kinetics, Reaction mechanisms, Pressure, Temperature.

The regeneration of sulfide-bearing melts with carbon dioxide and water vapor is studied. The regeneration reaction can be carried to completion at 500 C in a batch process within practical time limits (20 to 30 min). The time required to complete the reaction is limited by the input gas flow rate to melt volume ratio and the effective equilibrium constant for the regeneration reaction. Foreign metal impurities in the melt reduce the sulfide activity in varying amounts, causing a reduction in the hydrogen sulfide content in the off-gas stream. Calcium impurity does not affect the regeneration process. The effect of iron, a potential reduction catalyst, is studied in detail. Iron causes melts to foam during regeneration under certain conditions, and also precipitates along with some sulfide during the regeneration process. The iron-sulfide precipitate can be completely recovered from the regenerated melt by filtration and reused as a reduction catalyst. The optimum rates and utilitization of regeneration gases require low temperatures (less than 500 C) and carbon dioxide equilibrium pressure less than 0.5 atmospheres. The decrease in the effective equilibrium constant for the regeneration process with increase in carbon dioxide pressure is postulated to be due to the interaction of carbon dioxide with sulfide to form a series of thiocarbonates. Cycle tests show that the sulfur can be removed completely and reveal no problems due to cycling on the quality of the carbonate melt. (Author abstract modified)
APTIC-23526

### PREPULPING CHIP EXTRACTION TO REDUCE AIR POLLUTION. FINAL REPORT AND RECOMMENDED FUTURE RESEARCH.

Florida Univ., Gainesville, Engineering and Industrial Experiment Station, PHS Grants AP 00612-01 and AP 00612-02, 18p., Jan. 17, 1970.
William J. Nolan.
Identifiers: *Sulfite pulping, *Odor counteraction, Kraft pulping, Water pollution, Black liquor oxidation, Sodium sulfite, Hydrogen sulfide, Mercaptans, Ph.

Results are summarized and future work recommended from a study to determine whether rosin removal from chips before kraft pulping would permit efficient oxidation of dilute black liquors, and to explore the pulping of rosin-extracted chips by the neutral sulfite process. Prepulping rosin extraction had no benefits in black liquor oxidation. The following conclusions were drawn from this and other phases of the investigation. (1) Pulping of the southern pines with sodium sulfite solutions instead of conventional kraft solutions of sodium hydroxide and sulfide will prevent the formation of mercaptan, hydrogen sulfide, dimethyl sulfide, and disulfide, thus eliminating the air pollution problem characteristic of kraft pulping. (2) Sodium sulfite pulping (pH range 8.5-7.8) will produce pulps with improved yield in the range of 62-68%, with strong burst, tensile, and tear characteristics. (3) Small additions of sodium carbonate to the sodium sulfite liquors may benefit pulp strength. (4) Two-stage pulping with fibration between stages will improve pulp quality with probable lower equipment costs. (5) Three-stage screw press washers will reduce stream pollution to less than a fourth of that caused by conventional 3-stage vacuum washers. (6) Conventional kraft recovery equipment can be used to recover sodium sulfite waste liquors, replacing the recausticizing unit used in kraft recovery by three gas absorption towers. (Author summary modified)
APTIC-23538

### CATALYTIC CONVERTER--PANACEA OR PANDORA.

Air Pollution Control Assoc., Los Angeles, West Coast Section, Proc. Air Pollution Control Assoc., West Coast Sect., 1st Tech. Meet., Los Angeles, Calif., 1957, p. 52-59. (March 25-26.)
C. E. Fisher.
Identifiers: *Catalytic afterburners, *Automotive emission control, Engine exhausts, Internal combustion engines, Carburetion, Engine design modification, Design criteria, Hydrocarbons, Tetraethyl lead.

Three approaches to controlling the emission of unburned hydrocarbons from motor vehicle exhausts are represented by improved design of the internal combustion engine, carburetor fuel shut-off devices which restrict the flow of fuel during deceleration, and devices such as afterburners and catalytic converters that oxidize the combustibles contained in the exhaust. Gains from the first approach are offset by the development of larger displacement engines, while shut-off devices will produce only a 10-20% removal of hydrocarbons. Catalytic converters appear capable of oxidizing hydrocarbons to a level of approximately 100 ppm and thus offer the best possibility of success. However, their design and operation involve a host of problems including cost, space required for installation, length of time required to heat the catalyst, and deterioration of the catalyst at high temperatures. Costs of a unit will be reduced and its installation simplified by reducing the mass of catalyst required. A smaller catalytic bed will be heated to operating temperatures more quickly with resultant higher efficiency; it can be protected against excess temperatures by a thermostatically controlled air valve. These smaller beds will be a possibility, once lead which requires a large quantity of catalyst is removed from motor fuel.
APTIC-23540

### PROBLEMS OF MUNICIPAL INCINERATION.

For primary bibliographic entry see Field 01.
APTIC-23542

### RECENT RESULTS OF THE RESEARCH ON EXHAUST GASES DESULPHURIZATION.

(Neuere Forschungsergebnisse auf dem Gebiet der Abgasentschwefelung). Text in German.
Staub, Reinhalt Luft, 28 (3):89-93, March 1968. 13 refs. (Presented at the Verein Deutscher Ingenieure-Tagung, Schwerpunkte der Emissionsbekaempfung, Munich, Oct. 24-25, 1967.)
Harald Tuentgen, and Werner Peters.
Identifiers: *Stack gases, *Adsorption (general), Germany, Coal, Coke, Steam plants, Pilot plants, Sulfuric acid, Carbonates, Calcium compounds, Oxides, Reaction kinetics, Temperature.

The two methods of sulfur dioxide removal from exhaust gases of hard coal power plants were studied: the adsorption on activated coke, and its binding to powdered metal oxides or carbonates blown into the exhaust gas. In the first case, $SO_2$ is adsorbed on the coke surface and is oxidized to $H_2SO_4$. As the quality of coke used is the determining factor for the efficiency of the process, the preparation of suitable adsorbent and its properties were investigated. Hard coal coke produced by extrusion from pre-oxidized hard coal and with low flammability was most suitable. The laboratory conditions for optimum $SO_2$ adsorption and binding were found. The possibility of large-scale production of this coke and its use in continual $SO_2$ removal was considered. The advantages and drawbacks of three methods of coke regeneration were discussed. In the improved adsorption process coke was tested in 2 semi-industrial set-up. The method of $SO_2$ removal by powdered metal compounds was less expensive; the material used in the process was not regenerated. The dosage of powdered $CaCO_3$ or $MgCO_3$ into the reactor results in $SO_2$ or $SO_3$ binding to them. The chemicophysical conditions of the process were studied in the semi-industrial set-up described. At stoichiometric dosage of $CaCO_3$ and CaO powders into reactor at 800 C and at $SO_2$ concentration of 1200 ppm, 50% conversion was achieved. The reaction kinetics in a non-isothermic conditions was studied on a laboratory scale to improve the utilization of powders used as desulfirizers.
APTIC-23544

### THE REDUCTION OF ATMOSPHERIC POLLUTION FROM SULFURIC ACID RECOVERY PROCESSES.

Manufacturing Chemists Association,
Washington, D. C., Air Pollution Abatement
Committee and Manufacturing Chemists
Association, Washington, D. C., Water Pollution
Abatement Committee, Proc. Mfg. Chem. Ass.
1952-53 Pollution Abatement Conf., 9p.
N. W. Clauss.
Identifiers: *Mists, *Scrubbers, *Sulfuric acid, Costs, Chemical processing, Pilot plants, Bag filters, Decomposition, Water, Pressure.

Effluent gases from air-blown sulfuric acid concentrators contain sulfuric acid mist and sulfur dioxide resulting from the decomposition of sulfuric acid by carbonaceous materials present in the spent acid. A pilot plant was designed to study the removal of the mist by low-pressure water sprays, high-pressure water sprays, bag filters, and decomposition by heat. When the data obtained suggested that the high-pressure water spray system was most effective, a plant-scale acid mist removal unit was put into service. The sulfuric acid mist removal of the plant-scale unit appears to be higher than the efficiency obtained in the pilot spray unit, probably due to the elimination of wall effects. It is concluded that when the full capacity of the system is made available, the system can be operated, at a net operating cost (1953) of $5000 year, at maximum production rates with no pollution of the atmosphere by sulfuric acid mist.
APTIC-23556

### PROCESS FOR THE MANUFACTURE OF SULFUR THROUGH REDUCTION OF GASES CONTAINING SULFUR DIOXIDE.

(Verfahren zur Herstellung von Schwefel durch
Reduktion schwefeldioxydhaltiger Gase). Text in
German. (Assignee not given.) Ger. Pat. 693,468.
2p., June 13, 1940. (Appl. March 3, 1935, 3 claims).
Axel Rudolf Lindblad.
Identifiers: *Alkaline additives, *Reduction, Sweden, Combustion gases, Electrostatic precipitators, By-product recovery, Sulfur oxides control, So2 removal (combustion products), Hydroxides, Sodium sulfite, Carbon monoxide, Sulfates, Sulfides, Carbon disulfide, Hydrogen sulfide, Catalysts.

A method for preparing sulfur from sulfur dioxide in roasting gas emanating from the processing of pyrites and other sulfur containing ores is described in which SO2 is reduced by means of carbonaceous material in a gas generator. The reducing hot gas mixture is mixed with further quantities of SO2 or of an SO2 containing gas mixture and passed through a reaction chamber. Alkali or other alkaline compounds are mixed into the carbonaceous material or the carbonaceous material is impregnated with sodium carbonate, sodium sulfate or sodium sulfide in the gas generator; as a result, the reducing gas mixture reaching the reaction chamber contains alkali or other alkaline compounds in vapor or in dust form. In the gas generator, aside from sulfur, carbon monoxide, carbon oxysulfide, carbon disulfide, a small quantity of hydrogen sulfide forms. The reaction is strongly catalyzed by the alkali, so that reaction time is substantially decreased and SO2 is completely reduced. The temperature in the generator is kept between 700 and 1100 C. The reducing gases leaving the gas generator will reduce further quantities of SO2 in the reaction chamber to sulfur which is recovered by cooling and in a Cottrell precipitator. The alkali added to the system acts as a catalyst both in the generator as well as in the reaction chamber.
APTIC-23559

### THE TREATMENT OF WASTE GASES IN CHEMICAL INDUSTRY.

For primary bibliographic entry see Field 01.
APTIC-23562

### STORING LIQUEFIED HYDROCARBON GASES WITHIN FROZEN SOIL.

Gas Times, 98 (996):9, April 1964.
J. G. King.
Identifiers: *Storage facilities, *Design criteria, *Hydrocarbons, *Compressed gases, Great britain, Soils, Freezing.

To store liquefied hydrocarbon gases, it is proposed to excavate a basin in suitable soil, provide an appropriate form of cover which would be fully insulated thermally, and freeze the walls of the basin to form a container. Three weeks after filling the experimental basin at Lake Charles, Louisiana, the soil was frozen to a thickness of about 10 ft as depicted, and a temperature of O F was established at a distance of about 8 ft. The hole, 20 ft deep by 20 ft in diameter, was excavated in silt, sand, and clay. It is planned to build on a commercial scale one plant at Jersey Meadows for storing the equivalent of 32.6 million cu m of gas, and a second at Arzew, Algeria, for the storage of 30 million cu m of gas.
APTIC-23572

### REPORT ABOUT MEASUREMENTS OF WASTE GAS AT THE GRILLO DE-SULFURIZATION INSTALLATION AT UNION RHEINISCHE BRAUNKOHLEN-KRAFTSTOFF AG. FIRM IN WESSELING.

For primary bibliographic entry see Field 03.
APTIC-23575

### A NEW APPROACH TO INDUSTRIAL AIR POLLUTION CONTROL.

Heating Ventilating Engr. J. Air Conditioning
(London), 44 (517):80-85, Aug. 1970.
Personal Author Not Recorded.
Identifiers: *Incineration, *Flame afterburners, *Design criteria, Laboratory facilities, Hydrocarbons, Toluenes, Aerodynamics, Oxidation, Reaction kinetics, Temperature.

The exploration and development of technology and hardware to optimize the standards and pave the way for the most economical and efficient incinerator design possible are presented. Included in the laboratory research facility was a reaction chamber with probe connections for temperature and velocity measurements as well as compositions analysis for oxidation rates at various points. Extensive studies were made to furnish basic reaction kinetics of many hydrocarbon air contaminant materials, and mention is made to toluene as the most difficult of the samples shown to oxidize. To achieve effective mixing capabilities with extremely low air stream pressure loss, an incinerator burner which produces a 'ring of flame' was designed, and a full scale incinerator facility to accommodate this new burner was constructed. A series of tracer concentration measurements were performed to evaluate mixing efficiency of the burner, but the proof of performance was revealed in actual incineration tests using toluene. A complete mock-up of the jet incinerator was next constructed in the laboratory for aerodynamic studies previous to construction of practical equipment for commercial marketing. The purpose of the jet incinerator is not only to incinerate hydrocarbon process effluent, but also to be capable of developing a suction to entrain the fumes without requiring external exhausters or fans. A surface injection incinerator was designed as a very rugged, heavy duty type of combustion system for high temperature operation. This unit is equipped with a pair of burners firing tangentially at the combustion end to form a circular 'hot track' of burner gases in a restricted area. An injection nozzle is located axially at this point, where the process effluent is introduced under pressure and distributed directly into the burner combustion track. Typical problems of air pollution abatement to which these direct flame type fume incinerators find application are indicated.
APTIC-23584

### NEW BATTERIES USE ZINC-AIR COUPLE.

Power, 114 (8):44, Aug. 1970.
Norman Peach.
Identifiers: *Storage batteries, *Zinc compounds, Electric propulsion, Design criteria, Oxygen.

Advantages of the zinc-air battery being developed include a reduction in the quantity of electrolyte required, as well as elimination of supporting structures in the cell to hold the reaction products. This makes possible a lighter battery, while the reaction products do not build up on the plates to impede the reaction. A different mode of operation of the system has removable zinc plates, which are recharged by replating them externally. Practical energy density for the zinc-air system is 100 to 130 Watt-hr/kg, the higher value applying to larger batteries. To charge the battery a voltage is applied across the terminals. Zinc oxide is dissolved by the electrolyte and carried from the storage section into the cells, where it is decomposed into zinc and oxygen by the energy supplied by the charger. The zinc redeposits on the backing sheet as electroplated metal, and the pure oxygen evolved on the porous nickel is returned to the atmosphere.
APTIC-23593

### SEWER ODOR CONTROL.

Water Wastes Eng., 7 (7):43, July 1970.
James Kellum.
Identifiers: *Sewage, *Odor counteraction, Odors, Sewage treatment, Sewers, Baffles, Hydrogen sulfide.

A newly developed process is available for the control of odors in sewers, lift stations, and sewage treatment plants. The process involves the installation of a gas-producing unit into which air is introduced and passed through a series of baffles. With the passage of the air, electrical current is continuously discharged across the space between the baffles. The result is the production of an activated mixture of gases that, when discharged into a lift station or sewer line, eliminates more odors and prevents septicization and the formation of hydrogen sulfide. When used for upline treatment, the process is reported to raise the DO content of the liquid, promote aerobic biological growth, and reduce BOD where sufficient retention times are available. Other advantages claimed for the process and equipment are discribed.
APTIC-23594

### STOP SMOKING AND DODGE THE CLEAN AIR AXE.

Engineer (London), 231 (5975):20-21, July 1970.
Tony Morse.
Identifiers: *Smokes, *Natural gas, *Kilns, Costs, Clay, Great britain, Coal, Mineral processing.

By converting its coal-rifed kilns to natural gas, one British tile manufacturing company has eliminated emissions of black smoke, as required by the Clean Air Act, and increased productivity by about 55%. To date, nine beehive kilns, operating at positive pressure to produce an even distribution of temperature, have been converted at a cost of less than $63,000. Conversion has reduced the firing period from 14 days to 10, cutting fuel costs for each cycle from around $345 to $235. Important hidden gains are the reduction in brickwork needed for the kilns and increases in the percentages of first-class quality tiles produced. Conversion of more modern retangular kilns and a continuous kiln is also under way.
APTIC-23600

### POWER WITHOUT POLLUTION.

Sciences, 10 (5):10-14, May 1970. 1 ref.
Personal Author Not Recorded.
Identifiers: *Nuclear power plants, Costs, Combustion gases, Fuels, Electric power production, Steam plants, Solid waste disposal, By-product recovery, Lasers, Ionization, Ions, Radioactive radiation.

Conventional power plants burning fossil fuels produce objectionable combustion products; nuclear fission plants excessive heat, large quantities or radioactive waste, and risk runaway reactions. Recently substantial progress has been made in the development of a power source that has none of these defects and is, at the same time, economically feasible and virtually inexhaustible. Thermonuclear power could also be produced by controlled fusion reactors. Wastes would consist only of nonradioactive nuclei. Environmental thermal pollution would be reduced 50-70% below the values of existing power plants and there would be no possibility of an explosion. In the last two decades, plasma physicists and electrical engineers have developed variations on three basic systems, all of which meet safety criteria for controlled fusion: the theta pinch, the magnetic mirror, and the torus. Some have proved capable of generating near-thermonuclear temperatures, but none has yet overcome the problem of achieving adequate confinement of plasma. The fusion torch is another means of utilizing thermonuclear power. Here, diverted reaction products of fusion would vaporize solid waste materials, which would then be sorted by various techniques into electrified particles of component elements; an old automobile, for example, could be transformed into the iron, zinc, lead, and tin from which it was made, closing the materials cycle from use to reuse and supplying raw materials while disposing of garbage and solid wastes. Another advance in fusion technology within the last few years has involved the introduction of lasers for generating and heating plasmas. Although present-generation lasers are neither fast enough nor powerful enough to initiate a sustained, closed-loop fusion reaction, they have already generated very small amounts of thermonuclear fusion. Controlled fusion could provide a world-wide source of thermonuclear fusion. Controlled fusion could provide a world-wide source of thermonuclear energy for about 20 billion years at a tiny fraction of the cost of conventional fuels. Potentially, the economic advantage of controlled fusion is even greater because the kinetic energy of its charged reaction products may be transformed directly into electricity without the use of expensive, inefficient heat cycles.
APTIC-23603

### TREND IN THE AUTOMOBILE EXHAUST GAS PURIFICATION TECHNOLOGY.

(Jidosha haikigasu no jokagijutsu no doko). Text in Japanese. Kinzoku (Metals) (Tokyo), 40 (18):73-78, Sept. 15, 1970. 9 refs.
Shigeru Yanagihara.
Identifiers: *Design criteria, *Automotive emission control, Emission standards, Japan, Engine exhausts, Engine operating cycles, Electric propulsion, Internal combustion engines, Automobiles, Catalytic afterburners, Engine operation modification, Hydrocarbons, Carbon monoxide, Nitric oxide (no).

The emission standards for automobile exhaust emissions throughout the world are tabulated for carbon monoxide and hydrocarbons for different types of running and idling conditions. One of the present methods of emission control is the engine modification method, such as Chrysler Corporation's CAP (Cleaner Air Package). The main aim of CAP is the perfection of combustion inside the cylinders by improving the air-intake and ignition systems. Another method is the air injection reactor method. Detailed diagrammatic analysis of the system is presented. The electronic fuel injection control system whereby gasoline is injected into the intake manifold rather than into the carburetor is explained. With the future utilization of integrated circuits, this process is considered to be more practical in the future. The exhaust purification technology of the future is dependent on nitric oxide control by delayed firing, using exhaust reactors of high-temperature resistant materials, catalytic converters, land lead reduction from fuels. Diagrammatic examples are given for such items. Different types of engines other than the internal combustion engine such as external combustion engines and electrical motors are explained.
APTIC-23607

### THE METHOD AND APPARATUS FOR REMOVING DILUTE SULFUR OXIDES CONTAINED IN COMBUSTION EXHAUST GAS.

(Nensho haigasuto no naka ni fukumareru kihaku iwosankabutsu no jokyoho narabi ni sochi). Text in Japanese. Industrial Development Inst. foundation, Tokyo (Japan)) Japan. Pat. Sho 45-14886. 6p., May 26, 1970. 5 refs. (Appl. May 18, 1965, claims not given).
Arata Hori, Tomiyoshi Inoue, Shozo Yamamoto, Kazuo Tatara, and Masahiro Kitagawa.
Identifiers: *Adsorption (general), Costs, Charcoal, Japan, Combustion gases, Coke, Flow rates, Temperature.

A method is presented for the effective low-cost removal of dilute sulfur oxides from a large amount of combustion exhaust gas by means of activated carbon in the dry-type method. A layer of coke is installed above the active carbon layer to remove soot and ash. A part of the exhaust gas is diverted to have its heat used for drying and is subsequently mixed into the dried gas that is relatively low in temperature and sulfur oxides concentration, to form a gas with a suitable temperature for the adsorption process. The gas is then passed through the dry-type adsorption process and then released into the atmosphere. The significance of this invention is that it does not require fuels and water for temperature adjustment and thus is a very low-cost operation. The exhaust gas is frequently passed through the adsorption process for a complete dry process, thus avoiding the formation of mists in the atmosphere when it is released. Since the volume of the mixture gas that passes through the adsorption process is approximately equal to the original volume, extra blowers are not required. The drying period is flexible and thus the process is adaptable to fluctuations in the temperature and the flow rate of the original exhaust gas.
APTIC-23609

### CHEMICAL RECOVERY PROCESS FOR HIGH SULFIDITY SPENT COOKING LIQUOR.

(Koryukado jokaiyakubin kaishuho). Text in Japanese. Kami-pa Gikyoshi (J. Japan. Tech. Assoc. Pulp Paper Ind.), 24 (10):515-522, Oct. 1970. 7 refs.
Saburo Fukui, Masao Ono, Tooru Yoshii, Hiroshi Matsuura, and Hitoshi Sotobayashi.
Identifiers: *Paper manufacturing, *By-product recovery, *Absorption (general), Japan, Combustion gases, Stack gases, So2 removal (combustion products), Sodium carbonate, Sodium sulfite, Sulfites, Oxidation.

A new chemical recovery process for highly sulfurized spent liquor was developed for paper manufacturing whereby highly sulfurized smelt can be obtained by absorbing the sulfur dioxide in flue gas in a solution of sodium carbonate separated from smelt solution, and by burning the resulting sodium sulfite solution together with the spent liquor. The degree of sulfurization of smelt can be easily controlled by suitably adjusting the amount of sodium carbonate recycled to the recovery system and the amount of sulfur dioxide gas absorbed in the sodium carbonate solution. This new process enables cross recovery with sulfite recovery processes such as SP and SCP with a single recovery facility; since the spent liquor of both pulps can be recovered easily, the process is technically and economically advantageous. The recovery process can be divided into spent liquor mixing-concentrating, spent liquor burning, crystallization, sulfur dioxide oxidation, and caustization, each of which is explained in detail by means of graphs and tables.
APTIC-23611

### DO-IT-YOURSELF DUST SUPPRESSION SYSTEM SAVES MONEY.

Plant Eng., 24 (15):84-85, July 1970.
Rupert C. Vance.
Identifiers: *Dusts, *Mineral processing, *Control equipment, *Design criteria, Costs, Stone, Filters, Surfactants.

High levels of dust generation have long been associated with the stone processing industry, but a Massachusetts stone company designed and built their own dust suppression system for approximately $1500. Since their well and main pump were too far from the plant to provide sufficient pressure and volume, they mounted a used 20,000 gal glass-lined tank on a concrete block foundation alongside one of their crusher control houses. Use of the tank provides the additional benefit of isolating the system to ensure cleanliness, while the addition of a wetting agent to the reservoir water helps to settle the dust and keep the inside of the system and nozzles clean. All suction, bypass, and pressure piping was specified polyvinylchloride with the pressure line being adapted to standard 150 psi black plastic water pipe to feed the spray nozzles. Manifolds made from galvanized iron pipe were placed at the discharge chutes of all crushers except the primary crusher where a 20 gpm fog nozzle was installed. An inline, self-cleaning, 100 mesh filter was installed on the pressure line, and a 150 psi adjustable pressure regulator controls the bypass line. A schematic diagram of the system is included.
APTIC-23616

### EXPERIMENTAL INVESTIGATION OF CRITICAL DESIGN FACTORS FOR VANE TYPE CYCLONE COLLECTORS.

Preprint, American Society of Mechanical Engineers, New York, 17p., 1956. 12 refs. (Presented at the American Society of Mechanical Engineers, Annual Meeting, New York, N. Y., Nov. 25-30, 1956, Paper 56-A-199.)
A. B. Walker, and W. H. Cole.
Identifiers: *Design criteria, *Centrifugal separators, Dusts, Flow rates.

There is a considerable amount of information on the performance and design factors of dust collecting cyclones. However, this information is confined to tangential entry cyclones. Most of the so-called high efficiency mechanical collectors in use today are of the multiple-tube vane types. A basic investigation is made on the effects of tube size, inlet vane design and utilization of outlet tube vanes on the performance of this type collector. The critical nature of these factors and methods for obtaining higher efficiency and gas flow is demonstrated. A comparison between predicted field results from laboratory tests and actual field results is presented and the accuracy of specific laboratory techniques in predicting field performance indicated. (Author abstract modified)
APTIC-23626

### EXPERIENCE WITH THE APPLICATION OF WET COLLECTORS IN THE IRON AND STEEL INDUSTRY.

(Erfahrungen mit der Anwendung von Nassabscheidern in Eisen und Stahlhuettenwerken). National Society for Clean Air, London (England), International Clean Air Congress Proceedings, London, England, 1966, Part 1, p. 119-122. (Oct. 4-7, Paper V/2.) Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 10p., Oct. 23, 1969.
Otakar Storch.
Identifiers: *Venturi scrubbers, Iron, Steel, Czechoslovakia, Dusts, Primary metallurgical processing, Particle size, Collectors, Electrostatic precipitators, Flow rates, Pressure.

Since it is impossible to prevent hardening of deposited dust on wet collectors, they are no longer used in Czechoslovakia for the coarse-grained, agglomerative dusts produced in iron and

steelmaking processes. For coarse dust, electrostatic precipitators preceded by dry, mechanical separators are used. A new type venturi scrubber has been developed with a high efficiency for removal of metallurgical dusts in the micron and submicron range. The collector operates economically and reliably even when operating conditions are unfavorable. It has the following outstanding properties: a) It permits supply of water simply by mud pump without use of pressure. b) It distributes and atomizes the water uniformly over the entire cross section of the venturi tube. c) Its construction is simple, and each component is protected against corrosion. d) It requires no special maintenance service, since all components are readily accessible. The collector comes in seven sizes. They have standard capacities ranging from 3750 cu m/hr to 90,000 cu m/hr. They can operate with pressure losses from 200 to 900 kg/sq m. Ninety-eight% and 99.8% collection efficiencies are reported for FeMnC and FeSiMn, respectively, at a pressure loss of about 500 kg/sq m.
APTIC-23628

### PROCESS FOR PURIFYING SULPHUR DIOXIDE BEARING GASES.

(Assignee not given.) U. S. Pat. 2,090,828. 3p., Aug. 24, 1937. (Appl. June 25, 1932, 1 claim).
John W. Beckman.
Identifiers: *By-product recovery, *So2 removal (combustion products), *Reduction, Stack gases, Sulfur compounds, Catalysts.

A method is described for reducing sulfur dioxide-bearing gases completely to elemental sulfur without having any hydrogen sulfide in the exit gas. Thus, the only treatment required for the exit gas is removal of the elemental sulfur, and no sulfur or sulfur products are emitted to the atmosphere. The gas to be purified, dried and freed of sulfur compounds other than SO2, is passed into contact with a porous lime catalytic material together with a dry and non-sulfur bearing reducing gas (e.g., carbon monoxide), in specified proportions, at a temperature of about 400 C, to produce the elemental sulfur.
APTIC-23634

### RECOVERY OF ACIDIC GASES.

(Chemical Foundation, Inc., New York) U. S. Pat. 2,449,537. 4p., Sept. 21, 1948. (Appl. July 12, 1946, 12 claims).
Arthur W. Hixson, and Ralph Miller.
Identifiers: *By-product recovery, *Absorption (general), *Ammonium compounds, Stack gases, So2 removal (combustion products), Fluorides, Volatility.

A method is presented to remove and recover acidic gases present in relatively low concentrations in gas mixtures, with particular application to the recovery of sulfur dioxide from flue gas. The method is defined as a cyclic volatile base system involving a closed cycle into which only SO2 is introduced and withdrawn; high recoveries are insured because of the minimization of oxidation of the SO2. The process, a continuous one, comprises contacting the gas mixture with ammonia and water to form ammonium bisulfite and reacting this with an acid fluoride (an alkali metal fluoride or ammonium, potassium, or sodium acid fluoride) under conditions regulated to evolve SO2 and form a solution containing ammonium fluoride. The evolved SO2 is recovered and the ammonium fluoride solution thermally decomposed to separately recover ammonia and the acid fluoride, which are then recycled.
APTIC-23635

### REMOVAL OF HYDROGEN CYANIDE FROM AIR WITH ALKALI SOLUTIONS.

For primary bibliographic entry see Field 06.
APTIC-23637

### THE ROLE OF ELECTRIC FORCES IN THE FILTRATION OF AEROSOLS BY FIBER FILTERS.

J. Colloid Sci., vol. 10:299-314, 1955. 17 refs.
T. Gillespie.
Identifiers: *Aerosols, *Filter fabrics, *Electric charge, Great britain, Particle size, Flow rates.

Variations in experimental filtration results may be attributable to the role of electric forces in the filtration process. The net electric charge on the fibers of various filters and the electric charge distributions of typical test aerosols are measured. A simple theory of filtration which includes electric as well as mechanical forces is developed. Most fibers have an electric charge, even though it may be very small. The peak in the per cent penetration versus particle radius curves appears at approximately 0.05 micron, depending upon the velocity of the air through the filter. The presence of electric forces of induction decreases the penetration of large particles and tends to decrease the radius at which maximum penetration occurs. Some unexplained filtration results may be due to some aerosol particles escaping capture on contact. (Author summary modified)
APTIC-23640

### ON THE ADHESION OF DROPS AND PARTICLES ON IMPACT AT SOLID SURFACES. II.

J. Colloid Sci., vol. 281-298, 1955. 16 refs.
T. Gillespie, and Eric Rideal.
Identifiers: *Aerosols, *Droplets, *Particle growth, *Solids, Great britain, Particle size, Filters, Flow rates.

Applying a modified theory of elastic impact leads to a better understanding of the lack of adhesion of particles during filtration processes. A study of the oblique impaction of aerosol drops onto a solid surface is presented. The results of the study may be interpreted on the hypothesis that there is a range of velocities of impact in which adhesion on contact is not certain, and that the drops leave the surface at or near the point of impact. A high-speed photographic study reveals an elastic reaction on impact. The area of contact depends upon the velocity of impact and the drop size. When a drop strikes a surface, the area of contact might be relatively small for a considerable time. The real area of contact might be very small, presumably because of air trapped between the liquid and the solid. (Author summary modified)
APTIC-23641

### PROPOSAL FOR AN EMPIRICAL FORMULA FOR CHIMNEY HEIGHTS.

For primary bibliographic entry see Field 14.
APTIC-23643

### REMOVAL OF DUST FROM GASES.

In: Gas Purification Process. G. Nonhebel (ed.), London, George Newnes Ltd., 1964, Chapt. 12, p. 469-522. 25 refs.
C. J. Stairmand.
Identifiers: *Dusts, *Control equipment, Costs, Great britain, Operating variables, Particle size, Baffles, Centrifugal separators, Settling chambers, Electrostatic precipitators, Bag filters, Treated fabrics, Scrubbers, Packed towers, Spray towers, Venturi scrubbers, Wet cyclones, Design criteria, Electrical properties.

Various types of gas cleaning equipment are described, including their efficiencies, costs, and relative advantages and disadvantages. Inertial separators, or settling chambers, can be equipped with baffles to help remove the larger particles. Cyclones can be obtained in a variety of efficiencies and sizes. Scrubbers and wet washers are of two types: either the collection takes place by impingement on a wetted surface; or the scrubbing liquid, in the form of a spray, captures the dust. Packed towers, spray towers, venturi scrubbers, and wet cyclones are described in detail. The electrostatic precipitator is one of the most efficient dust collectors. Many electrical properties must be considered in the design of a precipitator. Fabric filters, either with standard fabric or treated, are usually in the bag-house configuration. The use of grade-efficiency curves to predict the performance of a control device is described. Costs of dust collection for a given particle size and efficiency range, including installation and operating costs, are provided.
APTIC-23644

### AN INVESTIGATION OF BOAT VENTILATION SYSTEMS.

Contract DOT-CG-93, 564-A, Assignment 69WW251, File MB-1, 103p., April 10, 1970.
CFSTI, DDC: AD706729
Personal Author Not Recorded.
Identifiers: *Boats, *Fuel tank evaporation, *Ventilation, Regulations, Carburetor evaporation losses, Running evaporative losses, Ships, Fans (blowers), Design criteria, Flow rates, Vapors.

An evaluation of boat ventilating systems is conducted to determine if the relevant safety regulations are being met. The regulations require a system capable of efficient removal of explosive or flammable gases from the bilges of every engine and fuel tank compartment. Results of the study indicate that the average system does not even come close to meeting that definition. Many fuel systems, even under non-leaking conditions, are capable of releasing a dangerous quantity of fuel vapor into the surrounding space. Any attempts to design a ventilating system in a boat must start with an analysis of how the shape of the boat affects airflow, both inside the hull and natural winds outside. Power ventilation by blowers is recommended, and a method for determining blower capacity is described. The experimental methods and equipment are described. Methods of eliminating vapors from the fuel system, engine, and other sources are included.
APTIC-23647

### DIMETHYL SULFOXIDE AS SOLVENT FOR SULFUR DIOXIDE.

Suom- Kemistiseuran Tiedonantoja, 58 (1-2):40-43, 1950. Translated from Swedish. Scientific Translation Service, Inc., Ann Arbor, Mich., 5p., 1969 (*). CFSTI: PB 187567-T
Tor Smedslund.
Identifiers: *Dimethyl sulfoxide, *Solvents, *Absorption (general), Europe, Combustion gases, Formaldehydes, Organic sulfur compounds, Decomposition, Pressure, Temperature.

Dimethyl sulfoxide has a remarkable capacity for dissolving sulfur dioxide. At 20 C and atmospheric pressure, 1 volume of sulfoxide dissolves 590 volumes of SO2. Absorption takes place with moderate heat production and an increase in volume of 1 to 2.03 volumes. However, sulfoxide is very unstable, particularly in the presence of acid media and decomposes at higher temperatures with the formation of formaldehyde. Even at ordinary temperatures, SO2 solution in dimethyl sulfoxide shows a gradual progressive decomposition when stored for a long time (4 months), thus constituting an insurmountable obstacle to the industrial use of sulfoxide for the absorption of sulfur dioxide.
APTIC-23651

### EFFECT OF USING ELECTROSTATIC FILTERS ON DUST EMISSIONS FROM LIGNITE-FIRED POWER PLANTS.

(Einfluss des Elektrofilterbetriebs auf die Staubemission aus Braunkohlenkraftwerken).
Text in German. Energietechnik, 17 (12):530-535, Dec. 1967. 4 refs.
Wolfgang Kluge, and Boeho Koeppe.
Identifiers: *Dusts, *Operating variables, *Electrostatic precipitators, Germany, Boilers, Coal, Furnaces, Electric power production, Design criteria, Electrical properties.

A series of experiments were conducted with two two-stage horizontal electrostatic filters made by a firm in Leipzig. These were connected to the exhaust line of boiler furnaces using lignite for fuel. The coal had a 51.5% water and 12% ash content. Determinations were made of changes in the degree of separating effectiveness over a long period of operation, and differences between filter equipment that had been cleaned and filter equipment that was dirty. Comparisons were made between the two filters, the second of which was equipped with a longer plate (8.5 m instead of 3.3 m), with a more recent type of electrodes and discharge points, and with a selenium rectifier, so that this filter operated at 400 mA and 75 kV, as compared with 200 mA and 40 kV for the first filter. Measurements obtained with the older-type filter were compared (with good agreement) with test results of 10 years previous, on the same type of equipment. Comparative tests with the second filter were made immediately after installation and about 6 months later. Dust content of the purified gases were determined as a function of filter current intensity at several states of filter current, from maximum down to zero mA. Further testing consisted in varying the operation of the discharge mechanism. Very little difference was noted between the two filters from the standpoint of 'clean' and 'dirty' operation but from the standpoint of heavy-duty operation, the new filter gave as high as 26% better performance, with an average improvement of 6%. In the current range of 300-400 mA, it was found by extrapolation that the use of the new type rectifier permits a significant decrease in the dust content of the purified exhaust, amounting to as much as one third of the total content. Elimination of a filtering stage had a significant effect on the filtering efficiency of the electrostatic stage. When an earlier stage was omitted, the dust content of the filtered air was 3 times as high; when a filtering stage following the electrostatic stage was omitted, the dust content was 4 times as high. The article also discusses the effects created by varying the discharge time, the influence on filtering efficiency of the manner in which the plant is operated, and procedures for monitoring the operation of an electrostatic filter, such as by the measurement and recording of electric current intensity.
APTIC-23674

### AN EVALUATION OF COAL CLEANING PROCESSES AND TECHNIQUES FOR REMOVING PYRITIC SULFUR FROM FINE COAL. (FINAL REPORT).

NAPCA Contract PH-86-67-139, BCR Rept. L-362, 135p., Feb. 1970. CFSTI: PB 193484, 193532
Personal Author Not Recorded.
Identifiers: *Coal characteristics, *Pulverized fuels, *Laundering (coal), Particle size, Wet cyclones.

An investigation into pyrite liberation and removal characteristics of U. S. coals, when pulverized to the two fine grinds of interest, is presented. Studies are also conducted on fine coal cleaning devices, notably the concentrating table and the compound water cyclone, to ascertain their potential for removing pyrite from fine sized coal. The use of the intermediate fractions lying between the clean coal and the high grade pyrite is studied. Additional information should be obtained on coal seams and/or areas that show potential for low-sulfur production. Results of the cleaning tests indicate that the pyrite in the finely ground coal is in the size range where poor separating efficiency is obtained, regardless of the method. A good grade pyrite concentrate can be made by a two-stage processing of the pyrite-rich refuse from the coal cleaning operation.
APTIC-23682

### SULFUR OXIDES AND OTHER SULFUR COMPOUNDS. A BIBLIOGRAPHY WITH ABSTRACTS.

For primary bibliographic entry see Field 07.
APTIC-23684

### REMOVAL OF SO2 FROM WASTE GASES.

Mitsubishi Juko, 2 (2):83-92, 1965. Translated from Japanese. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 43p., Nov. 12, 1969.
Masumi Atsukawa, Korechiko Nishimoto, and Kazhurio Matsumoto.
Identifiers: *Absorption (general), *Design criteria, Japan, Stack gases.

Economic and engineering problems to be resolved before application of wet methods of removing SO2 from waste gases are reviewed. Selection of a removal process is shown to be influenced by the limit of absorption, the velocity of the reaction, and the price of the absorbent. For instance, it is difficult to use organic solvents or basic aluminate sulfate on gases containing less than one percent SO2. The price of the absorbent comes into question because of the large losses when the SO2 content of a gas is low. Organic solvents and ammonia, for example, are easily lost because of their high vapor pressures. Another factor to be considered is the demand for and prices of compounds recovered from SO2 gases. Consumption in 1963 of recovered ammonium sulfate, sulfur, sulfuric acid, gypsum, sodium sulfate, and sodium sulfite are summarized in tabular form, as are the amounts of SO2 emitted by power plants, sulfuric acid plants, and nonferrous metal refineries. Variations in Japanese consumption of the by-products are illustrated graphically. The characteristics and pilot-plant data of four wet absorption methods are also presented. The methods are an ammonium process applicable to high-temperature gases from sulfuric acid manufacture, a manganese oxyhydroxide process with recovery of ammonium sulfate, limestone processes with or without recovery of gypsum, and a red mud method. In the latter the mud discharged when alumina is extracted from bauxite is the absorbent. It is feared that the methods are not applicable to power plants because of the following obstacles: generation of white smoke, decrease in the diffusability of the smoke, and corrosion inside chimneys. It is hoped these disadvantages can be overcome by a dry method now under testing. In this method, a solid absorbent is contacted with a gas at 100-140 C and the absorbent regenerated.
APTIC-23690

### HETERO-HOMOGENEOUS CATALYSIS OF AIR POLLUTANTS.

Massachusetts Inst. of Tech., Cambridge, Dept. of Chemical Engineering, NAPCA Grant AP00513, 34p., 1970. 38 refs. (Presented at the International Symposium on Chemical Reaction Engineering, 1st, Washington, D. C., June 8-10, 1970.)
C. N. Satterfield.
Identifiers: *Catalytic oxidation, *Catalysis, Hexenes, Toluenes, Flow rates, Free radicals, Reaction kinetics, Thermodynamics, Pressure, Temperature.

Hetero-homogeneous reaction refers to a process in which free radicals or other intermediates are formed on a solid catalyst and released to the homogeneous phase and propagate reactions there. There is some evidence for the reaction, and if it occurs under typical conditions for hydrocarbon oxidation, it could have a marked effect on optimum design and performance of catalytic reactors for oxidation of air pollutants. The oxidation of 700 to 1400 ppm 1-hexene in air at 1 atm on one to three platinum gauzes in series was studied in a 1.05 in. I.D. aluminum flow reactor. The homogeneous oxidation of hexene was also studied by inserting a 520 cc Pyrex glass reactor in the apparatus upstream of the catalytic reactor. Airflow rates were varied from 100 to 600 cc/sec (STP). At the high-temperature level (above 450 C), the homogeneous oxidation was first-order in hexene with an activation energy of about 60 kcal/mole. Significant quantities of by-products (incompletely oxidized products of hexene) were formed by the homogeneous reaction at high temperatures, but were not chemically identified. The catalytic life of the platinum gauze was usually less than 5 hours. The deactivation was believed to be caused by the diffusion to the surface of metal impurities in the platinum gauze. The catalyst could be reactivated by prolonged pickling in hydrochloric acid. The heterogeneous oxidation of hexene on active platinum gauze was characterized by the ignition of the reaction at approximately 350 C. The existance of a hetero-homogeneous reaction during the catalytic oxidation of hexene, if present, was beyond the detectability of the experimental technique. The catalytic oxidation of either 1-hexene or toluene on platinum gauze occurs by a mass transfer controlled reaction above approximately 350 C. Comparison of the rates observed with those predicted for mass transer to woven wire geometries gave no evidence of hetero-homogeneous processes. The homogeneous and heterogeneous combustion of hexene, when carried out simultaneously, occur by independent mechanism, the total reaction rate being the sum of the two. Significant by-products or intermediates produced during the homogeneous oxidation may be more difficult to catalytically oxidize than the hexene.
APTIC-23692

### CATALYTIC REMOVAL OF POTENTIAL AIR POLLUTANTS FROM AUTO EXHAUSTS.

In: Advances in Environmental Sciences. J. N. Pitts, Jr. and R. L. Metcalf (eds.), vol. 1, New York, Wiley-Interscience, 1969, p. 237-287. 131 refs.
Robert H. Ebel.
Identifiers: *Catalytic afterburners, *Automotive emission control, Automotive emissions, Engine exhausts, Crankcase emissions, Fuel evaporation, Gasolines, Power sources, Automobiles, Engine operation modification, Air-fuel ratio, Carburetion, Spark timing, Timed fuel injection, Engine design modification, Design criteria, Hydrocarbons, Lead compounds, Carbon monoxide, Nitrogen oxides, Combustion, Temperature.

A review of catalyst technology in relation to the control of hydrocarbons, carbon monoxide, and oxides of nitrogen is presented. The argument contained is principally for the systems approach to the problem of catalytic muffler design, the system to include all phases and modes of automobile design, operation, and maintenance. Rather than create one all-purpose device for all cars under all conditions, it is better to make the necessary trade-offs in carburetion, combustion chamber design, exhaust manifold design, fuel economy, maintenance schedules and techniques, and performance to obtain maximum emission control for each class of power train. The problem of lead pollution of the catalyst and back-pressure build-up would be handled by replacement in much the same way an air filter is replaced. Temperature is controlled by distance from the exhaust manifold; temperatures catalysts can handle rather than the real malfunction temperatures and frequent thermal cycling is discussed. Reliability data at temperature is based on steady state operating conditions cited in petroleum processing. An excellent, detailed discussion of carburetion and combustion is included in the description of the chemistry of pollutant generation. Choices available to the petroleum industry and the auto industry are listed and probable decisions specified. For the auto industry, the alternatives listed include an alternate power source, (steam or electric), modification of existing engines to meet increasingly restrictive emission limitations, or catalytic mufflers. A combination of the second and third choices is expected. Auto manufacturers have demonstrated that the average car in good condition can pass the California 7-mode test. Unfortunately, cars are mass-produced and vary, even when new, in accordance with the bell curve of distribution. Since every car will have to pass inspection, redesign will continue on engines, carburetors, and accessory systems for exhaust recirculation, fuel injection, air injection, and water injection. Production tolerances will be tightened as far as economically practical. But, in the end and at the end will be added one or

possibly two catalytic mufflers in series. In the latter case, oxides of nitrogen and the remaining pollutants would be separately oxidized.
APTIC-23697

### DEVELOPMENT OF REGENERABLE FIBERS FOR REMOVAL OF SULFUR DIOXIDE FROM WASTE GASES. (FINAL REPORT).

Uniroyal, Inc., Wayne, N. J., Research Center,
NAPCA Contract PH 86-68-74, 97p., July 1970. 2 refs. CFSTI: PB 193806, 193727
R. W. Fuest, M. P. Harvey, C. W. Lee, and S. A. Black.
Identifiers: *Treated fabrics, *Adsorption (general), Costs, Synthetic rubber, Stack gases, Humidity, Styrenes, Sulfates, Oxidation, Flow rates, Surface properties, Temperature.

The rate and capacity of sulfur dioxide sorption from SO2-nitrogen mixtures and from simulated flue gas mixtures by sorbent-loaded fibers were determined as a function of such variables as temperature, loading of sorbent in fiber, hydrophilicity, humidity in gas stream, fiber denier, and draw ratio of fiber. The effect of repeated sorption-regeneration cycling upon physical and sorptive properties of the fibers was studied, and the maximum temperature to which fibers could be exposed was determined. The greatest influence upon rate and capacity was the loading of sorbent polymer in the fiber. A significant technical achievement was the preparation of polypropylene-SSQ (styrene-dimethylaminopropyl maleimide copolymer) fiber containing 60% SSQ which had sufficient physical strength to allow fabrication into any desired type of assembly (felts, knits, woven fabrics, etc.). The effects of drawing the fiber, addition of hydrophilic material, and fiber denier were of much smaller magnitude. Regeneration studies were performed on the more promising fibers by carrying them through multiple cycles of sorpiton and regeneration. Thermal methods for regeneration (involving the use of inert gas, steam or vacuum) were investigated. An important finding was that oxidation of some of the SO2 to sulfate occurs during the sorption process, constituting an undesirable side reaction which is not reversible under normal regeneration conditions. Factors influencing the formation of sulfate and methods for restoration of the original sorptive capacity of the fiber were investigated. The sulfate could be removed from the fiber by treatment with aqueous base solutions. Preliminary economic analysis of the process showed that a long service life was a necessity for economic feasibility. (Author abstract modified)
APTIC-23698

### TRACE CONTAMINANT ADSORPTION AND SORBENT REGENERATION.

Lockheed Palo Alto Research Lab., Calif.,
Contract NAS 1-5847, Rept. L-62-69-1, 272p., Sept. 1970. 32 refs. CFSTI: NASA CR-1582
A. J. Robell, C. R. Arnold, A. Wheeler, G. J. Kersels, and R. P. Merrill.
Identifiers: *Carbon black, *Adsorption, Particle size, Spacecraft atmospheres, Diffusion, Reaction kinetics.

The adsorption and desorption characteristics of activated carbon are experimentally and theoretically investigated to determine the applicability of regenerable sorption to the control of airborne trace contaminants within spacecraft cabins for long mission durations. Capacity correlations for pure and mixed contaminants are established. A theory is derived and successfully tested for vacuum desorption rates from single particles and beds. A quantitative design methodology is developed for the practical design of regenerable systems. The rate-determining step is desorption from the external particle surface. Thus, the rate is inversely proportional to the particle diameter. For vacuum desorption from sorbent beds, the rate-determining step is Knudsen diffusion through interparticle voids. The Knudsen diffusivity has been experimentally measured. Although the single-particle studies showed that smaller particles desorb faster, the theory correctly predicts the surprising result that the opposite is true for beds: beds composed of larger particles desorb faster than those containing smaller particles. The desorption rate dependency on bed geometry, adsorption isotherm, and initial gas-phase concentration is also contained in the theory, and the theoretical predictions agree with experimental measurements. Neither experimental vacuum desorption rate data nor theoretical descriptions were available prior to this contract. In the course of this work, substantial information on both fronts has been generated, sufficiently to begin design work on a prototype unit.
APTIC-23700

### SULFURIC ACID FROM SULFUR DIOXIDE BY AUTOXIDATION IN MECHANICAL CELLS.

Bureau of Mines, Washington, D. C., Rept. of Investigation 6236, 24p., 1963. 18 refs.
Carl Rampacek, and J. B. Clemmer.
Identifiers: *By-product recovery, *Catalytic oxidation, *So2 removal (combustion products), *Sulfuric acid, Stack gases, Primary metallurgical processing, Pilot plants, Scrubbers, Iron compounds, Manganese compounds, Manganese sulfates.

The conversion of dilute sulfur dioxide gas into sulfuric acid by autoxidation in mechanical cells of the flotation or gas absorber types was investigated. Bench-scale tests were made with sulfur dioxide-air mixtures to determine the influence of several factors on autoxidation of sulfur dioxide, using iron and manganese salts as catalysts. The laboratory investigation subsequently was extended to pilot plant acid-making tests, using a modified turbomixer gas absorber having a 12-inch-diameter impeller. Sulfur dioxide gas was produced for the tests by roasting pyrite in a fluidized-bed reactor. In the better tests, made with manganese sulfate as the catalyst, the equivalent of 1000 pounds of anhydrous $H_2SO_4$ was produced per 24 hours as a 10-percent solution; power consumption was 0.2 kwhr per pound of equivalent anhydrous acid synthesized. When using manganese ore or flotation concentrate as the source of catalyst, the manganese consumption was about 50 pounds per ton of equivalent anhydrous acid produced. Extrapolation of data obtained in aeration tests in a modified gas absorber cell equipped with an impeller 18 inches in diameter indicated that the larger unit should have an acid-making capacity double that of the 12-inch unit without any increase in the energy required to produce a pound of equivalent anhydrous acid. (Author abstract modified)
APTIC-23701

### LEASE-GAS SWEETENING. PART 4. HOW TO DESIGN AMINE ABSORBERS.

Oil Gas J., 65 (38):112, 115-117, 119-121, Sept. 18, 1967. 14 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Design criteria, *Amines, *Hydrogen sulfide, *Scrubbers, Natural gas, Absorption, Mathematical analyses.

Design of the amine absorber and sour-gas stripper is the usual starting point for the preliminary design of an amine natural gas sweetening plant. The approach to absorber design calculations includes the following steps: estimate the solution rate, determine the column temperatures across the absorber resulting from the heat of reaction of the acid gases with the monoethanolamine solution, calculate the absorber diameter, and determine the absorber height. For illustrating the procedure involved, a problem is considered in which a natural gas stream of 50 MMscfd at 500 psig is to be sweetened. The sour gas contains 0.75% hydrogen sulfide and 3.8% carbon dioxide on a volume basis, and the gas is sweetened to 0.1 grain of $H_2S$/100 cu ft.
APTIC-23706

### IMPROVEMENTS IN AND RELATING TO THE REMOVAL OF OXIDES OF SULPHUR FROM FLUE GASES.

(Assignee not given.) Brit. Pat. 805,531. 5p., Dec. 10, 1958 (Appl. April 9, 1954, 10 claims).
Harold Earle Newall.
Identifiers: *Ammonium compounds, *Scrubbers, *Absorption (general), Great britain, Combustion gases, By-product recovery.

Sulfur oxides are removed from boiler flue gases by treating the gases with an aqueous solution of ammonium salts to which ammonia is added at a rate corresponding to the absorption of the sulfur oxides. The treatment is carried out in a multi-stage scrubbing tower; in the first stage, the flue gases are scrubbed with a concentrated solution, while in successive stages progressively more dilute solutions are used. The final solution has a concentration of ammonium salts not more than one tenth and preferably not more than one twentieth of that in the first stage, and contains ammonium sulfate with only a trace of sulfites. Overall efficiencies of 95-98% are obtainable, with very low loss of ammonia.
APTIC-23707

### SO2 REMOVAL FROM STACK GAS FEATURED AT APCA MEETING.

Civil Eng. (N. Y.), 37 (8):94, Aug. 1967.
Personal Author Not Recorded.
Identifiers: *Alkaline additives, Air quality measurement programs, Control agencies, Costs, State governments, Stack gases, Residual oils, Electric power production, Scrubbers, By-product recovery, Fuel oil preparation.

A method of desulfurizing power plant stack gases was described at the June 1967 meeting of the Air Pollution Control Association in which a portion of pulverized, calcined alkaline earth is injected into the furnace with the pulverized coal, and the resulting compound is removed by wet scrubbing. The limestone doubled the amount of material recovered but did not reduce dust-collecting efficiency. The method was claimed to remove 90-98% SO2 at an operating cost of 36 cents/ton coal, plus a capital cost of $2.20/kw plant capacity. A report on removing SO2 before combustion of Caribbean residual fuel oil gave an added cost of 72 cents/6.3 million-Btu barrel for reducing 2.6% sulfur content oil to 1%. An Illinois-Indiana Interstate Air Pollution Control Commission is being created by legislation in both states; a telemetered air-monitored network and closed circuit TV system with cameras have recently begun operation in the area.
APTIC-23708

### MINED CAVERNS NIXED AS LNG STORAGE UNITS.

Oil Gas J., 64 (37):191-192, Sept. 12, 1966.
Personal Author Not Recorded.
Identifiers: *Compressed gases, *Natural gas, *Storage facilities, Costs.

Although mined caverns have proven profitable for storing propane, propylene, and butane for many years, studies indicate that they have distinct economic disadvantages for liquefied natural gas when compared with other types of LNG storage. Three basic disadvantages are discused: higher building and operating costs; higher heat gain, adding to the overall expense; and unfavorable geological conditions in many areas, involving keeping all water out of the cavity and the cost of protecting rock formations from instability due to the extreme low temperatures required. On the basis of heat gain alone, unlined storage caverns have a cost disadvantage of about $1.-1.50/bbl when compared to frozen inground storage and $2-3 compared with aboveground tankage.
APTIC-23709

### NEW DESIGN OF EVAPORATOR UNITS FOR CANVEY ISLAND METHANE TERMINAL.

Gas Times, 99 (1007):18-19, March 1965.

Personal Author Not Recorded.
Identifiers: *Design criteria, *Methanes, *Compressed gases, *Evaporators, Construction materials, Aluminum, Steel, Zinc, Great britain, Heat transfer.

Two evaporator units designed for the Canvey Island liquid methane terminal near London are described. One unit uses the sea water at ambient temperature as the direct heating medium for evaporating the liquid methane; the heat transfer surface comprises a series of aluminum panels. Sections of the plant can be operating independently to give a flexible capacity range and additional panels can easily be incorporated to increase the capacity. The second, more complex unit uses liquid propane as an intermediate heat transfer medium between the sea water and the liquefied gas. The unit is more efficient and eliminates icing-up of the heat transfer surfaces. In addition, by adding a circuit containing a superheater, expansion turbine, and propane condenser, it can be converted to provide power for generating some of the electricity used at the terminal.
APTIC-23710

### REMOVING HYDROGEN SULFIDE FROM SYNTHESIS GAS WITH IRON OXIDE AT ELEVATED PRESSURE.

Bureau of Mines, Washington, D. C., Rept. of Investigation 6023, 27p., 1962. 14 refs.
G. E. Johnson, J. H. Field, W. A. Decker, and R. M. Jimeson.
Identifiers: *Absorption, *Hydrogen sulfide, *Pressure, Fuel gases, Iron oxides, Oxygen, Catalytic activity, Flow rates, Temperature.

Bench-scale studies showed that purification of synthesis gas using wood chips impregnated with iron oxide can reduce the hydrogen sulfide content below the arbitrarily established limits of 0.02 and 0.10 grain per 100 cubic feet for nickel methanation and Fischer-Tropsch catalysts, respectively. Operating pressures and temperatures, bed depth, and moisture content of the impregnated wood shavings are important factors in the design and operation of iron oxide units. The allowable gas throughput for a given sulfur removal increases linearly with pressure. An average of 0.356 gram of hydrogen sulfide was removed per gram of $Fe_2O_3$ on the shavings in the bench-scale tests using a 2-foot bed depth, compared with a stoichiometric value of 0.64 gram of hydrogen sulfide per gram of $Fe_2O_3$. However, as the efficiency of removal was improved by increasing the depth of the bed of wood chips from 6 inches to 24 inches, a value closer to the theoretical can probably be achieved in commercial operation using beds about 10 feet in depth. The effectiveness of hydrogen sulfide removal was decreased at elevated temperature. Decreased effectiveness of removal at elevated temperature was caused partly by loss of moisture from the chips. Relatively dry absorbent gave considerably poorer removal of hydrogen sulfide at room temperature than chips containing 50% moisture. Regeneration of $Fe_2S_3$ to obtain $Fe_2O_3$ by oxidation with air is effective for renewing the activity of the spent absorbent. No loss of activity was indicated through five cycles of absorption and regeneration. Tests made with a feed gas containing a lower concentration of hydrogen sulfide (5 grains per 100 cubic feet compared with 10 grams) gave considerably greater removal before a sulfur breakthrough occurred in the exit gas. However, the small quantity of oxygen in the feed gas may have increased the efficiency.
APTIC-23712

### INVESTIGATIONS CONCERNING THE PROBLEM OF BACK DISCHARGE IN ELECTROSTATIC PRECIPITATORS.

Staub (English translation from German of: Staub, Reinhaltung Luft), 30 (3):11-18, March 1970. 9 refs.
Eva-Marie Koschany.
Identifiers: *Dusts, *Electrostatic precipitators, *Voltage, Germany, Operating variables, Electrical properties, Electric charge.

Highly insulated dusts are associated with the back discharge phenomenon in electrostatic precipitators, the occurrence of which leads to a reduction in breakdown voltage, a multiple rise in precipitator current, and jumps and unsteadiness in current voltage characteristics. Four methods of testing for back discharge were investigated, as were the effects of electrode geometry and voltage shape on collector efficiency for dusts with insulating properties. Conditions causing back discharge were successfully identified by comparing current-voltage characteristics obtained, respectively, during increases and decreases in precipitator voltage. Precipitator currents, dew points, and temperatures promoting back discharge of certain dust types are summarized in tabular form. The study of variations in electrode geometry and voltage type and polarity showed that highest collection efficiencies are obtained at smooth dc current and with a discharge system consisting of barbed-wire electrodes alternating with sheet metal strips. The positive influence of this discharge system is attributed to the fact that no charge carriers are produced in the gas space between the strips and the collecting electrode, the field being homogenized.
APTIC-23717

### THE CONTROL OF POLLUTION, ESPECIALLY OF GASEOUS EMISSIONS.

(Zur Reinhaltung der Luft, insbesondere von gasfoermigen Emissionen). Text in German. Inst. Gewerbliche Wasserwirtschaft Luftrein-Haltung Forum, vol. 65:352-358, 1965. 9 refs.
E. Wahnschaffe.
Identifiers: *Desulfurization of fuels, *So2 removal (combustion products), Germany, Combustion gases, Coal, Coke, Fuel gases, Natural gas, Fuel oils, Electric power production, Pilot plants, Stacks, By-product recovery, Catalytic oxidation, Hydrodesulfurization, Absorption (general), Alkaline additives, Experimental methods, Sulfuric acid, Sulfur compounds.

Atmospheric emission of sulfur dioxide in West Germany in 1963 was due to coal (79%) and to heating oil (21%). Power stations emitted 29% of all $SO_2$. To keep $SO_2$ within permissible limits, industry builds high stacks because emission concentration at ground level decreases with the reciprocal square of the stack height. The desulfurization of heating oil is expensive; oils with less than 2% sulfur content are advantageous. Desulfurization of coal is not feasible; the use of coal with low sulfur content is desirable. The various processes in operation for the removal of $SO_2$ from the industrial gases are reviewed. German experimental processes not yet accepted or introduced by industry include the Johwich process currently in pilot plant operation in which $SO_2$ is absorbed by semicoke at 120 C and regnerated at 400 C; the iron oxide process in which $SO_2$ is catalytically converted to $SO_3$ at 200-450 C and the $SO_3$ is converted to sulfate on an iron oxide saturated carrier (lab. stage); the sulfacid process (formerly Pauling process) which absorbs $SO_2$-containing waste gas at 60 C by active carbon, oxidizes it to $SO_3$, and recovers sulfuric acid; and an additive process which blows natural basic oxides or hydrates of oxides of alkaline earth into the furnace at 1400 C and converts thus all sulfur compounds to sulfates.
APTIC-23718

### WE'VE DONE THE JOB - WHAT'S NEXT"

Preprint, Society of Automotive Engineers, Inc., New York, 12p., 1969. 37 refs. (Presented at the Society of Automotive Engineers, Metropolitan Section, New York, April 9, 1969, Paper 690539.)
Charles M. Heinen.
Identifiers: *Automotive emission control, Automotive emissions, Internal combustion engines, Automobiles, Vapor recovery systems, Engine design modification, Design criteria, Hydrocarbons, Carbon monoxide, Nitrogen oxides.

The nature of the present controls and of possible future controls is examined for the three primary automotive emissions of carbon monoxide, hydrocarbons, and oxides of nitrogen. With the 1970 vehicles in California and the 1971 vehicles nationally, evaporative losses from the gas tank and the carburetor will be better than 90% controlled. No matter which path the crankcase blow-by gases take, with the crankcase controls they will wind up being recycled through the engine. In the vapor control system, the charcoal canister is used as a storage container for the fuel vapors, while in the evaporative control system the engine crankcase is used to store the evaporated fuel. Many wedge-shaped combustion chambers have been altered to eliminate the close clearance zone in the quench area, which has resulted in hydrocarbon reductions of approximately 30 ppm. To obtain more uniform fuel-air mixtures and improved cylinder-to-cylinder distribution, there have been modifications of the main and boost venturis, use of the triple venturi, more precise control of throtte-operated bowl vents, and extensive modifications to the idle system. Air injection into the exhaust manifold has also been used extensively to provide reductions in carbon monoxide and hydrocarbons as a result of combustion beyond the engine.
APTIC-23719

### A SUPERIOR COLLECTING PLATE FOR ELECTROSTATIC PRECIPITATORS.

Preprint, American Society of Mechanical Engineers, New York, 7p., 1959. 2 refs. (Presented at the American Society of Mechanical Engineers, Annual Meeting, Atlantic City, N. J., Nov. 29-Dec. 4, 1959, Paper 59-A-279.)
Harry J. White, and Walter A. Baxter Jr.
Identifiers: *Electrostatic precipitators, *Design criteria, Costs, Cements, Particulates, Dusts, Fly ash, Furnaces, Open hearth furnaces, Industrial emission sources, Mineral processing, Paper manufacturing, Baffles, Rapping, Aerodynamics, Electrical properties.

The basic importance of collecting-electrode design to over-all precipitator performance is analyzed, and a scientific program leading to the development of greatly improved collecting plates broadly applicable to a wide range of practical applications is described. A newly-designed solid collecting plate with triangular baffles was evaluated for fundamental and practical performance criteria, including electrical characteristics, aerodynamic properties, precipitation rate, rapping requirements, weight, and cost. The solid plate was superior in every measured characteristic to an expanded-metal plate tested under the same conditions. The new plate has been successfully applied to fly ash, cement, powered catalyst, gypsum and alumina dust, paper-mill, oxygen converter, and open-hearth fume, and other recovery problems. (Author abstract modified)
APTIC-23725

### INVESTIGATION OF AEROSOL FILTRATION WITH THE AID OF A MODEL FILTER.

Colloid J. (USSR) (English translation from Russian of: Kolloidn. Zh.), 27 (1):74-78, Jan.-Feb. 1965. 6 refs.
L. V. Radushkevich, and V. A. Kolganov.
Identifiers: *Aerosols, *Filters, *Simulation, Ussr, Particle size, Aerosol generators, Flow rates.

Model filters were constructed for an investigation of aerosol filtration that consisted of successive sections, i.e., Duralumin plates, each having a 1.6-cm diameter orifice across which polymer fibers were stretched. Filter samples varied according to the number of plates (80-372), number of fibers per plate, grid density, section coverage, and average fiber diameter. The filters were placed in an aerosol-generating chamber, and particle concentrations and size distributions were determined for the original aerosol and the aerosol passing through a filter. The results are presented in tables of partial efficiencies of various filters at velocities of 0.4 and 5.0 cm and in graphs of the relations

between breakthrough coefficients and particle diameters for the same filter with different numbers of sections and for different filters with different numbers of sections. Despite the considerable differences between the filter parameters, all the partial efficiencies for the respective diameters at the same velocity are similar. The values of partial breakthrough coefficients differ greatly. The results are considered evidence of the good reproducibility of the filters made by the method described, and justify the design of the model. The proposed design has implications for the study of filtration problems that might be hard to solve with real filters due to the complex structure of the latter.
APTIC-23729

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### DEHYDRATION OF NATURAL GAS AND LIGHT HYDROCARBON LIQUIDS. PART IV. HOW LOW TEMPERATURE SEPARATION CAN DO THE TRICK.

Petrol Refiner, 32 (1):138-142, Jan. 1953. 14 refs.
John M. Campbell, and Lawton Laurence.
Identifiers: *Natural gas, *Drying, *Compressed gases, Costs, Humidity, Hydrocarbons, Cooling.

One of the four basic methods of dehydrating natural gas is refrigeration wherein the gas temperature is lowered below its original dew point. Although the cost of an absorption or compression type refrigeration plant cannot be justified when dehydration is the only factor, the use of mechanical refrigeration equipment to recover natural gasoline fluids is increasing because of the favorable economics in many cases, and dehydration is automatically accomplished. The use of any pressure differential between the wellhead and the sales line to produce refrigeration by expansion, however, can show an excellent payout in addition to the dehydration accomplished. Advantage of this is now being taken in the dehydration of high pressure gas from gas distillate wells. Principles of expansion refrigeration are reviewed; and process, dew point factors and economics are considered with respect to expansion systems in which hydrates are allowed to form and are then melted. Advantages and disadvantages of these low-temperature separation units are summarized.
APTIC-23730

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### DEHYDRATION OF NATURAL GAS AND HYDROCARBON LIQUIDS. PART III. LIQUID DESICCANT PLANTS.

Petrol. Refiner, 31 (11):109-116, Nov. 1952. 26 refs.
John M. Campbell, and Lawton L. Laurence.
Identifiers: *Natural gas, *Absorption, *Drying, Costs, Operating variables, Sulfuric acid, Alcohols, Chlorides, Hydrocarbons, Calcium compounds, Lithium compounds, Amines, Compressed gases, Vapor pressure.

Absorption-type dehydration plants offer the advantages of continuous desiccant circulation, a high degree of flexibility, and relatively low costs. However, until recently, their use was limited by the availability of liquid desiccants that would give a high dew-point depression and yet be relatively nonvolatile and noncorrosive. In addition to these prerequisites, a good liquid desiccant should maintain its drying ability over a wide range of concentrations; have a low vapor pressure at operating conditions; not have an excessive viscosity; be easy to regenerate without special equipment; be nontoxic; and have a low heat of reaction and heat of solution. The principal liquids now in use include triethylene glycol, diethylene glycol, glycol-amine water mixtures, calcium chloride, glycerine, lithium chloride, and sulfuric acid. The properties of these liquids and their advantages and disadvantages are listed, as are cost factors and operating variables in glycol dehydration systems.
APTIC-23731

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### DEHYDRATION OF NATURAL GAS AND LIGHT HYDROCARBON LIQUIDS. PART I. PRINCIPLES OF DEHYDRATION.

Petrol. Refiner, 31 (8):65-70, Aug. 1952. 157 refs.
John M. Campbell, and Lawton L. Laurence.
Identifiers: *Natural gas, *Condensation, *Drying, Absorption, Adsorption, Humidity, Hydrocarbons, Cooling, Compressed gases, Water, Vapors, Pressure, Temperature.

The rapid growth of the natural gas industry in the last decade has increased the necessity to provide adequate dehydration facilities, both in field gathering systems and long transmission lines. Regardless of the dehydration method used, the driving force causing the vapor to leave the gas and condense must be larger than the force which tends to make the liquid vaporize. Any method of dehydration is thus a means of either reducing vaporization tendency or increasing the driving force causing condensation of the water vapor. With any system, at a given temperature and pressure, an equilibrium will eventually be reached, water vaporizing at the same rate at which it condenses and no change occurring in the water content of the gas with time. While this equilibrium can only be approached in commercial equipment, the concept of equilibrium is a convenient means of analyzing and explaining the mechanism of dehydration. In this review, it is applied to the four basic methods of dehydration: compression to a higher pressure with subsequent cooling; cooling below initial dew point; adsorption with dry desiccants; and absorption with liquids.
APTIC-23732

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### TENNESSEE GAS BUILDS IN-GROUND STORAGE FOR 1-MILLION BARRELS OF LNG.

World Petrol., 38 (4):118, 120, 122-123, April 1967.
Ray Gibson.
Identifiers: *Storage facilities, *Natural gas, *Compressed gases, Concrete, Soils, Scrubbers, Control methods, Absorption, Design criteria, Methanes, Propanes, Amines, Carbon dioxide, Hydrogen sulfide, Compression, Cooling.

A liquefied natural gas facility under construction in New England will liquefy for storage up to 12.5 mmcfd of natural gas. Storage capacity will be 3 billion cu ft of gas, while the regasification facilities will be able to vaporize from a minimum of 20 mmcf/d to a maximum of 248 mmcf/d. In the liquefaction unit, incoming gas will first pass through a monoethanolamine scrubber, where carbon dioxide and hydrogen sulfide will be removed. The purified gas will then enter a molecular-sieve dry bed, where its temperature will be reduced to -100 F. Further cooling to -40 F and -140 F by propane and ethylene refrigerants, respectively, will take place in aluminum heat exchangers. From the heat exchangers the gas will move in stages through 'flash pots,' further temperature reductions occurring with each 'flash' until all the gas is liquid. The stored LNG will consist of approximately 97% methane with the rest ethane and propane. Two storage pits, each 135 ft in diameter and 172 ft deep, were excavated in earth overlaying solid granite. Prior to excavation, chilled brine was circulated to a depth of 195 ft to establish a 15-ft-wide wall of frozen earth around each tank site. The top 30 ft of each hole consists of a reinforced concrete ring extending down to the surface of the granite, below which the granite itself serves as the wall. LNG will be moved from storage to the revaporization heat exchanger through high-pressure pumps.
APTIC-23733

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### DEHYDRATION OF NATURAL GAS AND LIGHT HYDROCARBON LIQUIDS. PART VI. THE USE OF ADSORPTION AND DISTILLATION TO DRY LIQUIDS.

Petrol. Refiner, 32 (3):151-156, March 1953. 21 refs.
John M. Campbell, and Lawton L. Laurence.
Identifiers: *Natural gas, *Adsorption, *Drying, *Compressed gases, Corrosion, Scrubbers, Design criteria, Hydrocarbons, Propanes, Water, Steam.

The production and processing of light hydrocarbon fluids results in quantities of water being present in the system. Since water and these liquids are largely insoluble, substantial quantities of free water are often present. This free water is a serious source of corrosion and scale formation problems. While these problems can be handled satisfactorily in product pipelines by the use of rust inhibitors, dehydration offers a more positive approach at reasonable cost. At the present time, dry desiccant adsorption plants dehydrate the bulk of the liquid in product pipelines, due to their flexibility and the ease with which products of varying composition can be handled without undue control problems. With liquids such as propane, distillation type plants are applicable, and normal specifications can be obtained with this system at lower initial and operating costs. Dry desiccant plants for liquid service use the same desiccants as gas but their design considerations are somewhat different, particularly with regard to the regeneration cycle. The most commonly used regeneration systems are classified as closed vapor systems, closed steam systems, open vapor regeneration systems, and open steam systems. The disadvantages and advantages of each are noted, together with recommended usage. Distillation drying is discussed with respect to design factors, stripping column specification, and number of plates necessary. Included is a summary of methods of testing for water content.
APTIC-23734

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### DEHYDRATION OF NATURAL GAS AND LIGHT HYDROCARBON LIQUIDS. PART II. DRY DESICCANT SYSTEMS.

Petrol. Refiner, 31 (10):106-112, Oct. 1952. 13 refs.
John M. Campbell, Wickliffe Skinner Jr., and Lawton Laurence.
Identifiers: *Natural gas, *Adsorption, *Drying, Costs, Operating variables, Scrubbers, Design criteria, Humidity, Aluminum compounds, Aluminum oxides, Silicon compounds, Compressed gases, Solids.

Although other dehydration systems have been developed that offer greater economic advantage, a large percentage of the gas dehydrated in this country is still processed by dry desiccant systems. These offer the advantage of low exit dew point and give effective dew point depression over a wide range of operating conditions. Adsorption type desiccants more nearly fulfill the requirements set forth for dry desiccants than do reaction type desiccants and are consequently used more widely for dehydration of natural gas. These adsorption type desiccants fall into two categories: the gel type and the alumina type. Several varieties of each are available, all of which vary both in composition and cost. The properties of the various adsorbent dessicants are listed, and their relative drying efficiencies are compared. Also noted are gas conditions affecting adsorption, designs available for the dry desiccant tower, factors affecting regeneration of the dessicant, and the importance of pressure drop to the desiccant system. A cost curve is included for estimating initial costs of dry desiccant dehydrators.
APTIC-23735

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### DEHYDRATION OF NATURAL GAS AND LIGHT HYDROCARBON LIQUIDS. PART V. TAKING ADVANTAGE OF HYDRATE INHIBITORS WITH EXPANSION REFRIGERATION.

Petrol. Refiner, 32 (2):131-134, Feb. 1953. 9 refs.
John M. Campbell, and Lawton L. Laurence.
Identifiers: *Inhibition, *Natural gas, *Drying, *Compressed gases, Costs, Alcohols, Cooling.

The use of a hydrate inhibitor in conjunction with expansion refrigeration minimizes the two chief limitations of the system: the hydrate temperature when cooling prior to the choke, and the necessity

of melting the hydrates formed. All glycols are effective inhibitors, but current economics favor diethylene glycol. A glycol injection system with stabilizer is discussed and illustrated in a flow diagram. In this system, the inlet wellstream enters the knockout with or without prior cooling. Just downstream from this knockout, prior to the heat exchanger, the optimum amount of glycol is injected. This glycol then flows through the heat exchanger across the choke into the separator with the wellstream gas where it is separated with the condensate. Separation can be accomplished in a higher pressure-low temperature separator, the condensate going to stage separation or a stabilizer and the glycol to the reconcentration system. It can also be carried out at low-pressure glycol-oil-gas separator after running the total stream through a stabilizer or heater. Stabilization is far more efficient than stage separation and is recommended in virtually all cases. By this means, weathering is minimized in the stock tank without excess flare gas losses from separator equipment. Performances of low-temperature separators with the same heat exchanger, with and without the inhibitor, are compared graphically. Also presented are initial cost estimation curves for glycol injection systems with stabilizer and data on stock tank recovery with stage separation vs. stock tank recovery with stabilization. While initial and operating costs are slightly higher for glycol injection systems than for other low-temperature systems, the former are considered to give the best ultimate payout.
APTIC-23736

### A COMBUSTION CHAMBER DESIGNED FOR MINIMUM ENGINE EXHAUST EMISSIONS.

Preprint, Society of Automotive Engineers, Inc.,
New York, 13p., 1970. 11 refs. (Presented at the
Society of Automotive Engineers, Mid-Year
Meeting, Detroit, Mich., May 18-22, 1970, Paper
700491.)
H. K. Newhall, and I. A. El Messiri.
Identifiers: *Engine design modification, Engine exhausts, Engine operating cycles, Spark ignition engines, Automotive emission control, Air-fuel ratio, Combustion, Design criteria, Carbon monoxide, Nitric oxide (no).

Results of early development are reported on a modification of the combustion process which exploits the finite time dependence of the nitric oxide formation in high temperature combustion products. Nitric oxide formation was reduced to a low level by use of a divided combustion chamber in which the main chamber, comprising 65-85% of the total clearance volume, is separated from the engine cylinder by a dividing orifice. A fuel injector supplies fuel to the primary chamber only. System geometry and injection timing are so arranged that at no time is raw fuel allowed to enter the secondary chamber, which is adjacent to and bounded on one side by the piston crown. The application of the combustion process follows a four stroke engine cycle. This design simultaneously promotes complete oxidation of hydrocarbons and carbon monxoide as well as nitric oxide, thus resulting in total control of exhaust emissions. Basic factors leading to these reduced emissions are discussed at length, although results were obtained under conditions not representative of typical vehicle driving cycles. Problem areas include combustion roughness, fuel-air mixture formation, and power output.
APTIC-23739

### SIXTY PERCENT LESS EXHAUST GAS POSSIBLE WITH TODAY'S METHODS, 70 WITHIN REACH.

(60 procent mindre avgaser mojligt med dagens
metoder, 70 inom rackhall). Text in Swedish. Tek.
Miljo, 2 (2): 32-35, March 1970.
Sven-Erik Morstedt.
Identifiers: *Automotive emission control, Costs, Emission standards, Sweden, Engine exhausts, Automobiles, Catalytic afterburners, Air-fuel ratio, Engine design modification, Hydrocarbons, Carbon monoxide, Combustion, Temperature.

The exhaust gases of automobiles from 1971 and on are limited to maximum concentrations of carbon monoxide of 45 g/km, and of hydrocarbons 2.2 g/km. These concentrations represent approximately 40% reductions over vehicles without controls. The car manufacturers intend to meet the requirements with engine modifications. The effects of engine modifications on three different cars are investigated at an exhaust laboratory. Reductions of 60% are observed with up-to-date control equipment. Of about 40 control methods tested, the catalytic afterburner is the most promising. The direct fired afterburner creates a maximum temperature of about 900 C, requiring as a result expensive heat-resistant materials. Another problem encountered is the variation in exhaust temperature due to discontinuous engine loading. Manifold air injection requires much space, a stainless steel exhaust system, and contributes to poor combustion in the engine. Installation and maintenance costs are determined for cars equipped with the various controls.
APTIC-23746

### LEASE-GAS SWEETENING. PART 1. HOW TO CHOOSE A TREATING PROCESS.

Oil Gas J., 65 (33):131-133, Aug. 14, 1967. 4 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Natural gas, *Absorption, *Carbon dioxide, *Hydrogen sulfide, Operating variables, By-product recovery, Catalytic oxidation, Carbonates, Potassium compounds, Sodium compounds, Amines, Iron oxides, Phosphates, Sulfur compounds, Catalysts, Liquids, Water, Solids, Vapors, Pressure, Temperature.

Natural and manufactured gases contain such undesirable compounds as hydrogen sulfide, carbon dioxide, and water vapor. In most cases, these materials must be removed before the gas can be transported and sold. The choice of a suitable process depends on types of impurities in the gas stream and their concentration levels, the degree of removal required, the acid-gas selectivity required, the volume of gas to be processed, and the temperature-pressure conditions at which the gas is available. Of the different sweetening processes, liquid absorption is the most widely used. Included in the liquid absorption/desorption process are the alkanolamine, hot potassium carbonate, water washing, Seaboard and vacuum carbonate, tripotassium phosphate, and sodium phenolate processes. New absorption/desorption processes gaining in popularity include the Giammarco-Vetrocoke, Catacarb, Shell Sulfinol, and Fluor solvent processes. Sulfur recovery is not a characteristic of any of these processes, but it is possible by oxidizing the desorbed hydrogen sulfide in another part of the plant. Liquid absorption/oxidation processes, which are characterized by the oxidation of hydrogen sulfide and the recovery of elemental sulfur, include the Ferrox, Manchester, Thylox, Giammarco-Vetrocoke, Perox, Stretford, and Townsend processes. The advantages, disadvantages, and applications of the processes named are noted. Solid processes are briefly noted; they include the iron oxide process and several molecular sieve processes.
APTIC-23750

### REMOVAL OF RADIOACTIVE AEROSOLS ON HIGH EFFICIENCY FIBROUS FILTER MEDIA.

Oak Ridge National Lab., Tenn., Reactor
Chemistry Div., AEC Contract W-7405-eng-26,
55p., June 1970. 18 refs. CFSTI: ORNL-4524
R. J. Davis, J. Truitt, J. S. Gill, and R. E. Adams.
Identifiers: *Aerosols, *Filter fabrics, *Radioactive radiation, Smokes, Reactors (nuclear), Particle size, Filters, Mathematical modeling, Humidity, Flow rates, Temperature.

Results are reported of a study to (1) observe filtration efficiencies of commercially available, high efficiency fibrous filter media to smokes of those materials possible, and under environmental conditions expected, in water-cooled reactor containments during a severe accident, and (2) to provide additional understanding of the performance of high efficiency fibrous filters. The basic experiment was a test in which a radioactive aerosol was pumped through a series of three samples of the filter media being tested; filter efficiency was the ratio of activity on the first filter to the total on all three. The experiment measured filter efficiencies in the range near 99.97% to plus or minus 0.01-0.02, and the method gave efficiency values in good agreement with those measured with 0.3-micron DOP particles. The eight different commercial media provided similar efficiencies. The effects of increasing velocity, of increasing the temperature, of increasing humidity, or of steeping the media in saturated, 80 C steam and air prior to use, increased the penetration by factors of 1.5 to 2. Subsidiary experiments gave information on fiber diameter and action, particle size, and penetration from holes. Approximate values of filtration efficiency (vs particle size) and of the effects of several parameters were calculated using available filtration theory and using the fiber diameter data observed. These were qualitatively similar to the observed effects. (Author abstract modified)
APTIC-23751

### SULFUR DIOXIDE EMISSIONS.

For primary bibliographic entry see Field 05.
APTIC-23757

### EVALUATION OF FABRIC FILTER AS CHEMICAL CONTACTOR FOR CONTROL OF SULFUR DIOXIDE FROM FLUE GAS. (FINAL REPORT).

Air Preheater Co., Inc., Wellsville, N. Y., NAPCA
Contract PH22-68-51, 174p., Dec. 31, 1969.
CFSTI: PB 194196
Han Liu, and Robert Chaffee.
Identifiers: *Bag filters, *Absorption (general), Limestone, Stack gases, Fly ash, Hydroxides, Calcium compounds, Sodium compounds, Nitrogen dioxide (no2), Flow rates, Reaction kinetics, Reaction mechanisms, Temperature.

The sorption of sulfur dioxide by sodium bicarbonate, nahcolite, hydrated dolomitic lime, promoted hydrated dolomitic lime, and hydrated lime was studied using a full scale pilot fabric filterhouse as the chemical contactor under various operating conditions. A total of 62 tests was performed to determine the effects of sorbent stoichiometric ratio, operating temperature, flue gas rate (filter ratio), mode of house operation, method of sorbent feeding, and sorbent retention time. In addition to the measurements of SO2 concentration and all the operating parameters, the mixture of the sorbent and flyash collected at the bottom of the filterhouse hopper was also sampled and analyzed. This was carried out in an attempt to determine how much of the SO2 removal was taking place while the sorbent was in suspension and how much was taking place in the filtercake on the bags. In general, sodium bicarbonate and nahcolite reacted similarly but considerably differently from the hydrated limes. At higher temperature, near the sodium bicarbonate decomposition point, 518 F, the highest achieved SO2 conversion efficiency was 98.4% with a stoichiometric ratio of 2. For nahcolite, the highest conversion efficiency was 96.2% with a stoichiometric ratio of 1.2; and for dolomitic lime, the highest was 48.6% with a stoichiometric ratio of 3 at 640 F. The percent of the total SO2 removal taking place in the gas stream before deposit of the sorbent on the filterbags with sodium bicarbonate and nahcolite was different from that with the hydrated limes. The major part of SO2 removal with sodium bicarbonate and nahcolite took place on the bags at medium temperatures while the major SO2 removal for the hydrated limes took place while the lime was in suspension in the gas stream. The observations on the relative amounts of SO2 removal taking place in the gas stream and on the bags are based on limited data and requires further tests for substantiation. Measurements of nitrogen dioxide were also made during the tests. (Author abstract modified)
APTIC-23761

### PROCESS FOR THE REMOVAL OF OXIDES OF SULFUR FROM GASES.

(Verfahren zur Entfernung von Schwefeloxyden aus Gasen). Text in German. (Lonza Elektrizitaetswerke und Chemische Fabriken A. G., Basel (Switzerland)). Swiss Pat. 357,825. 5p., Dec. 15, 1961. (Appl. June 17, 1957, 4 claims).
Alfons Egger.
Identifiers: *Scrubbers, *Absorption (general), *Ammonium compounds, Europe, Combustion gases, Coal, Fuel oils, By-product recovery, So2 removal (combustion products), Ammonia, Carbonates, Sulfates, Sulfides, Sulfites, Oxidation, Ph.

Sulfur dioxide is removed from combustion gases of coal and mineral oil and of consumer gas by washing with an aqueous solution of ammonium sulfate, ammonium sulfite, ammonium bisulfite, and ammonium carbonate which is kept at a pH from 5.5 to 7.5 by additions of ammonia. Ammonium sulfite and bisulfite are formed, and sulfur is recovered in usable form. The washing solution which contains 400 to 600 g ammonium sulfate, 18 to 180 g ammonium sulfite, 15 to 150 g ammonium bisulfite and 1 to 3 g ammonium bicarbonate per l is kept in circulation while ammonium sulfate formed by oxidation is continuously precipitated. The 3-5% SO2 contained in the gas can by this method be practically completely converted to pure ammonium sulfate. The residual SO2 content in the gas is less than 0.0002% by volume. The gases enter washing towers at 150 -200 C and leave them at 45-70 C. The oxidation of the sulfite to sulfate is accomplished with air at the bottom section of the washing towers or in separate oxidation vats at relatively low temperatures without catalysts. A hundred kg solution yields 2-3.5 kg ammonium sulfate in one run.
APTIC-23773

### THE FORMATION OF SULFUR BY THE REACTION OF SULFUR DIOXIDE WITH CALCIUM SULFIDE, ZINC SULFIDE, AND IRON SULFIDES.

(Ueber die Bildung von Schwefel bei der Einwirkung von Schwefeldioxyd auf Calciumsulfid, Zinksulfid und die Eisensulfide). Text in German. Z. Anorg. Allgem. Chem., vol. 127:273-294, 1923.
Lothar Woehler, F. Martin, and E. Schmidt.
Identifiers: *By-product recovery, *So2 removal (combustion products), *Catalytic oxidation, Germany, Combustion gases, Calcium compounds, Iron compounds, Zinc compounds, Sulfates, Sulfides, Catalysis, Chemical reactions, Reaction mechanisms, Temperature.

The reaction between SO2 and CaS conforms to the equation CaS plus 2 SO2 yields CaSO4 plus 2 S up to 1000 C; above 1000 C, it follows the equation 2 CaS plus SO2 yields 2 CaO plus 3 S. While the first reaction comes to a quick standstill as a result of the envelopment of CaS by gypsum, the second reaction can be carried to completion with the addition of CaO or CaC03 accelerating the reaction velocity. The reaction between zinc blende and SO2 follows the equation 2 ZnS plus SO2 yields 2 ZnO plus 3 S. The reaction velocity is slow because the sulfide is being enveloped by a basic sulfide. The reactions between iron sulfide or pyrite with SO2 result in a quick complete conversion of the sulfides to Fe304 and sulfur with iron oxydul oxide further reducing reaction time by its catalytic effect based on the prevention of sintering. Pyrite does not require a catalyst. The oxidation of CaS to CaSO4 can also be catalyzed by iron oxydul oxide. The catalysis is based on the intermediary formation of CaO and FeS.
APTIC-23774

### REDUCTION OF LOW POWER SMOKE EMISSION FROM AN INDUSTRIAL GAS TURBINE ENGINE.

Preprint, American Society of Mechanical Engineers, New York, 8p., 1970. 2 refs. (Presented at the American Society of Mechanical Engineers, Gas Turbine Conference and Products Show, Brussels, Belgium, May 24-28, 1970, Paper 70-GT-103.)
T. R. Koblish, and H. R. Schwartz.
Identifiers: *Smokes, *Gas turbines, *Air-fuel ratio, Engine exhausts, Stack gases, Distillate oils, Stacks, Aerosol generators, Combustion.

In certain applications, gas turbine engines used for stationary or marine power must on occasion operate in a power range far below normal engine idle speed. At this low power range, conditions are least favorable for good combustor performance. As a result, operation at these conditions with heavy distillate fuels may result in the emission of white acrid smoke from the engine exhaust stacks. Concern over this situation prompted the initiation of a burner rig program to determine the effect of fuel atomization and stratification on combustion stability, combustion efficiency, and quantity of 'white' smoke emission. The program tests results indicated that the white smoke at low idle conditions can be eliminated or at least substantially reduced, with no deterioration in performance or smoke at high power, by increasing the local fuel air ratio within the burner front end and by improving fuel atomization. (Author abstract modified)
APTIC-23776

### LEASE-GAS SWEETENING. PART 14. IRON-OXIDE PROCESS DESIGN CALCULATIONS.

Oil Gas J., 66 (33):74-75, Aug. 12, 1968. 5 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Packed towers, *Catalytic oxidation, *Iron oxides, *Hydrogen sulfide, *Design criteria, Natural gas, Adsorption, Carbon dioxide, Sulfur compounds, Catalysts, Flow rates.

Design criteria for the iron-oxide sweetening process and a sample calculation are presented. The main goal in the design of the process vessels is to maximize use of the iron oxide and extend the life of the bed. Bed life can be calculated from the amount of sulfur in the gas and the type of operation employed. Several grades of iron sponge are available, while the most common is a 9-lb grade containing 9 lb Fe203/bushel of sponge. To determine bed diameter, heat effect considerations and contact time in the bed are utilized. An iron-oxide process should have two or more purification vessels so that revivification or bed changeout of each can be done without complete shutdown. The vessels should be installed on legs with provisions for dumping the spent sponge and charging fresh sponge. A bed height of at least 10 ft has been found necessary to produce a sufficient pressure drop and give proper distribution of gas across the bed as well as a high-gas velocity. The sample problem pertains to a 6 MMscfd gas at 750 psig and 85 F. The gas contains 30 grains/100 scf of hydrogen sulfide and 2% carbon dioxide, and it is necessary to sweeten the gas so that no more than 0.5 grains/100 scf of H2S remains.
APTIC-23777

### LEASE-GAS SWEETENING. PART 13. SOLIDS PROCESSES FOR GAS SWEETENING.

Oil Gas J., 66 (25):90-93, June 17, 1968. 12 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Natural gas, *Adsorption, *Catalytic oxidation, *Mercaptans, *Hydrogen sulfide, Operating variables, Scrubbers, Aluminum silicates, Aluminum oxides, Iron oxides, Catalysts, Solids, Surface properties.

Solids sweetening processes, which are applicable to natural gas with small-to-medium concentrations of hydrogen sulfide or mercaptans, are based on adsorption of the acid gases on a bed of solid sweetening agent. The iron oxide or dry-box process is based on the oxidation of H2S by ferric oxide which is present in a hydrated form. Iron sponge is most generally recommended and employed in typical natural gas sweetening problems. Regeneration can be induced by what is known as continuous revivification or by batchwise regeneration with a spent bed of iron sponge. Continuous revivification is obtained simultaneously with the sulfide oxidation reaction if a fraction of a percent of oxygen is present in the gas, or if a small amount of air is introduced with the sour gas feed. Batch regeneration is accomplished by taking off stream a tower and circulating air and gas through it. Process steps, an example sweetening problem, and areas of applicability are discussed. Several molecular sieve processes, usually mostly characterized by their regeneration scheme, are available. Molecular sieves are crystalline structures grown from alkali metal alumin silicates, and their surface area is adsorptive toward any molecule which can pass into the pores. Tower regeneration and applicability of the process are discussed.
APTIC-23778

### LEASE-GAS SWEETENING. PART 11. LIQUID ABSORPTION-OXIDATION PROCESSES SHOW MUCH PROMISE.

Oil Gas J., 66 (20):100-103, May 13, 1968. 9 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Natural gas, *Absorption, *Catalytic oxidation, *Hydrogen sulfide, Operating variables, By-product recovery, Alcohols, Ammonium compounds, Arsenic compounds, Quinones, Iron compounds, Sodium carbonate, Oxides, Iron oxides, Sulfur dioxide, Sulfur compounds, Catalysis.

The Ferrox and Manchester, Thylox, Perox, and Townsend processes are discussed as they absorb hydrogen sulfide from sour gases and the oxidize it to elemental sulfur. The sweetening agent is iron oxide suspended in an alkaline, aqueous solution in the Ferrox and Manchester processes. Hydrogen sulfide reacts with sodium carbonate to give sodium hydrosulfide and sodium bicarbonate, and and the sodium hydrosulfide then reacts with iron oxide to form iron sulfide. Regeneration consists of aeration of the spent solution, converting iron sulfide to elemental sulfur and iron oxide. The Manchester process differs from the Ferrox process only in the use of multistage treating of the sour gas. Thylox treating solution is prepared from arsenic trioxide and sodium carbonate dissolved in water. Its current application is generally limited to coke oven gas treating. The sulfur generated by the process is of sufficiently high purity to be used in agriculture, and it can be used as a raw material for manufacturing various chemicals, since it contains less than 0.5% arsenic. The Perox process involves absorption of H2S in an aqueous ammonia solution containing 0.3% of an organic oxidation catalyst such as hydroquinine. Ammonium hydrosulfide is yielded which is oxidized to elemental sulfur by contact with air. The Townsend process sweetens sour gas by contacting the gas with sulfur dioxide in the presence of an inert organic solvent such as di- or triethylene glycol.
APTIC-23779

### LEASE-GAS SWEETENING. PART 10. THESE EARLY PROCESSES MAY FIT SOME SWEETENING NEEDS.

Oil Gas J., 66 (11):85-87, March 11, 1968. 5 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Natural gas, *Absorption, *Carbon dioxide, *Hydrogen sulfide, Operating variables, Scrubbers, Phenols, Esters, Potassium compounds, Sodium carbonate, Phosphates, Water, Steam.

Water washing, the Seaboard process, a vacuum carbonate process, a sodium phenolate process, and a tripotassium phosphate process are considered for the sweetening of sour gases. Absorption of acid gases such as hydrogen sulfide and carbon dioxide in water is considered a physical absorption, and the capacity of water for the acid gases is directly proportional to its partial pressure. Low cost and ready availability of the sweetening agent are two obvious advantages. However, an additional process must be used to sweeten the gas to normal specifications, and high pumping loads are required for water circulation. The solution in the Seaboard process, which

usually contains 3-3.5% sodium carbonate, scrubs the sourgas stream in a countercurrent contactor and is regenerated in an actifier column by a countercurrent flow of warm, low-pressure air. Side reactions caused by the introduction of oxygen are the main disadvantage. The vacuum carbonate process is essentially a modification of the Seaboard process, in which regeneration of the spent sodium carbonate solution is by vacuum distillation rather than air stripping. Vacuum distillation results in a steam requirement of about one-sixth that required for steam stripping at atmospheric pressure. The sodium phenolate process employs a fairly concentrated solution of sodium phenolate in a conventional heat regenerative flow cycle. Hydrogen sulfide is absorbed by tripotassium phosphate in an old Shell Development Company process, and regeneration is by addition of heat.
APTIC-23780

### LEASE-GAS SWEETENING. PART 9. ECONOMICAL NEW SOUR-GAS TREATING METHODS AVAILABLE.

Oil Gas J., 66 (4):91-94, Jan. 22, 1968. 5 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Absorption, *Carbon dioxide, *Hydrogen sulfide, Natural gas, Operating variables, By-product recovery, Catalytic oxidation, Arsenic compounds, Carbonates, Ethers, Potassium compounds, Amines, Oxides, Catalysis, Steam.

The Vetrocoke-Azotati firm discovered several organic and inorganic activators for increasing the rate of reaction between carbon dioxide and carbonate. Two processes were developed as a result: a CO2 removal process, and a hydrogen sulfide removal process. The H2S process involves oxidation, and the H2S removed from the gas stream is recovered as elemental sulfur rather than regenerated H2S gas. Either small amounts of organic or large quantities of inorganic substances in hot alkali carbonate solutions are utilized in the CO2 removal process. The inorganic additives are most effective and include arsenic trioxide and selenous and tellurous acid, which act as catalysts to increase the rate of CO2 absorption and to improve the desorption sufficiently to permit the use of air stripping at moderate temperatures. In the Catacarb process, an undisclosed catalyst is used to activate a potassium carbonate solution, and increase the CO2 removal by 40% while using the same amount of steam. El Paso Natural Gas Company has developed the diglycolamine process which involves a new treating agent, beta-beta hydroxyamino ethyl ether, or Diglycolamine. This new process appears applicable to gas streams containing 2 to 8% total acid gas, but limitations include the tendency of the solution to form high-boiling degradation products. A modification of the process was developed by the Societe National des Petroles d'Aquitaine for natural gas sweetening. Gas containing 9% to more than 25% H2S is treated and reduced to 0.05 to 0.15 grain H2S/100 scf.
APTIC-23781

### LEASE-GAS SWEETENING. PART 8. PHYSICAL SOLUTION IS THE KEY TO THESE TREATING PROCESSES.

Oil Gas J., 66 (2):78, 80-81, Jan. 8, 1968. 12 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Natural gas, *Absorption, *Carbon dioxide, *Hydrogen sulfide, Solvents, Carbonyls, Esters, Hydrocarbons, Amines, Mercaptans, Thiophene, Sulfides, Carbon disulfide, Water, Vapors, Pressure, Vapor pressure.

Several new processes have appeared for hydrogen sulfide and/or carbon dioxide removal in natural gas sweetening, and foremost among these are the Fluor solvent process, Shell's Sulfinol process, the Giammarco-Vetrocoke processes, and the Catacarb process. In 1960, three patents were issued to Fluor Corporation covering the organic solvents propylene carbonate, glycerol triacetate, butoxy -diethylene-glycol acetate, and methoxy-triethylene-glycol acetate when used for the adsorption of CO2 from high-pressure gas streams. Since only a physical absorption of the gases is involved, the carrying capacity of the solvent will be almost directly proportional to partial pressure of the acid gases. The solvents will pick up water vapor, carbonyl sulfide, carbon sidulfide, mercaptan, and hydrocarbons, as well as CO2 and H2S. They are noncorrosive to carbon steel, and low solvent vapor pressures result in low vaporization losses. Chemical stability is good with no solvent degradation experienced. A typical application of the Fluor solvent process is discussed. The Shell process utilizes Sulfolane (tetrahydrothiophene dioxide) and any of the alkanolamines for the sweetening agent. Sour gas is contacted countercurrently with the sweetening agent at approximately ambient temperature, and the spent solution is regenerated at near atmospheric pressure and high temperatures. With part of the acid gas being physically held by the Sulfolane, compared to all being chemically bound to the amine, regeneration heat requirements will be less than required for aqueous amine processes. Because of the higher loadings obtainable with the Sulfinol solution, less solution needs to be circulated; the regenerative heat requirements are decreased significantly.
APTIC-23782

### LEASE-GAS SWEETENING. PART 7. DESIGNING A HOT-CARBONATE PROCESS.

Oil Gas J., 65 (46):122-124, 129-131, Nov. 13, 1967. 10 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Scrubbers, *Design criteria, *Carbonates, Natural gas, Operating variables, Absorption, Mathematical analyses, Carbon dioxide, Hydrogen sulfide, Flow rates, Thermodynamics, Temperature.

Design of a hot carbonate natural gas sweetening system includes an estimation of solution rate, a check of temperatures across the absorber resulting from heat of reaction, the calculation of absorber diameter, and determination of absorber height or number of trays required. Example calculations pertain to a natural gas stream of 50 MMscfd at 500 psig. The stream contains 12% carbon dioxide and 1% hydrogen sulfide, and the gas must ultimately be sweetened to 0.25 grains H2S/100 scf and 0.5% CO2. An acid-gas pickup of 2.5-3 scf/gal is most applicable for commercial designs, and 2.5 scf/gal pickup for the 25% K2CO3 solution will be used in this example. The solution circulation rate for this carrying capacity would be 1500 gpm. Absorber temperatures are fixed by first assuming the sour gas is available at the absorber at 200 F, possibly by preheating with the hot sweet gas leaving the absorber. The temperature of the sweet gas leaving the top of the absorber will approximately equal the temperature of the lean solution entering the absorber, which is the temperature of the solution from the stripper reboiler. Temperature of the spent solution leaving the absorber is determined by a heat balance to account for the heat of reaction of the acid gases absorbed. To calculate the column diameter, use is made of the correlations for limiting the gas velocity to a tolerable liquid entrainment in plate columns, and to flooding point for packed columns. Because of the high liquid-to-gas ratio of the problem, a packed tower or a plate tower with split-flow trays might be used. A simple McCabbe-Thiele graphical technique estimates the number of theoretical trays to be 1.3 which is equivalent to 26 actual plates. Stripping column calculations involve estimating the heat load for the reboiler and sizing the column. Stripper design is discussed.
APTIC-23783

### LEASE-GAS SWEETENING. PART 2. MEA PROCESS TO BE CONSIDERED FIRST.

Oil Gas J., 65 (34):83-85, Aug. 21, 1967. 2 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Natural gas, *Absorption, *Amines, *Hydrogen sulfide, Petroleum refining, Control methods, Reduction, Vapor pressure.

Monoethanolamine is the strongest base of the different amines, and hence reacts most rapidly with acid gases. Aqueous MEA has found its most general application in the sweetening of wellhead natural gas, where it will easily reduce the hydrogen sulfide content to less than 0.25 grains/100 cu ft. Its principal disadvantages are that it will react with carbonyl sulfide and carbon disulfide to form nonregenerative compounds, and that its vapor pressure is higher than that of the other amines. The aqueous diethanolamine process finds its most common application in sweetening refinery-gas streams that have been exposed to cracking conditions. Here carbonyl sulfide and carbon disulfide are usually encountered. Compared with either the MEA or DEA process, aqueous triethanolamine is less reactive with the acid gases, has a smaller capacity per gallon of solution, is less stable, and cannot reduce the H2S content to some pipeline standards. The principal advantage of the TEA process is the fact that it is selective towards hydrogen sulfide. Aqueous methyldiethanolamine systems combine the advantages of a tertiary amine--selectivity and lower vapor pressure--with the fact that they are more stable and more reactive than TEA, and have a slightly greater capacity. Use of mono- or diethanolamine with diethylene glycol has found considerable application in simultaneous sweetening and dehydration of high-pressure natural gas. Main equipment items in an amine sweetening plant are the absorber where the sour gas is sweetened, and the stripper where the foul amine solution is regenerated. Process steps are indicated.
APTIC-23784

### LEASE-GAS SWEETENING. PART 3. WHERE AND WHY TO WATCH FOR SYMPTOMS OF CORROSION, FOAMING.

Oil Gas J., 65 (35):116-117, Aug. 28, 1967. 4 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Foaming, *Corrosion, *Control equipment, Aluminum, Steel, Natural gas, Operating variables, Filters, Scrubbers, Absorption, Design criteria, Amines, Hydrogen sulfide, Temperature.

Mechanical design and operating problems of hydrogen sulfide gas-treating equipment include corrosion, foaming, amine losses, and entrainment of nonacidic gases. Corrosiion will be most severe at places where the highest concentrations of acid gases encounter the highest temperatures. These points include the reboiler, the stripping column, and the amine-amine heat exchanger. Also, in these vessels, the corrosion rate will be highest at points of extreme turbulence, or of high metal stress. Stainless steels and aluminum alloys may be considered in place of carbon steel. Other design and operating measures that will reduce the corrosion problem include providing an effective filtration and amine reclaimer system; placing the rich solution in the heat-exchanger tubes rather than the shell in the rich-lean amine exchanger; using the low-pressure steam for reboiler heat; sizing the equipment for low velocities; keeping oxygen out of the system; stress relieving all piping and vessels; and maintaining low reboiler temperatures and the lowest possible pressure on the stripping column and reboiler. Foaming may result from finely divided, suspended solid particles, dissolved hydrocarbons, and some of the amine degradation products. The best cure is proper care of the amine solution, including adequate filtration and reclaiming. Amine losses can result from entrainment in the gas stream, vaporization, and chemical degradation. Entrainment losses can be prevented by the use of effective mist-extraction equipment, and by adequate foam prevention, while thermal degradation is usually eliminated with good design and operating techniques.
APTIC-23785

### LEASE-GAS SWEETENING. PART 5. HERE ARE PRINCIPAL PROBLEMS IN DESIGNING STRIPPING TOWERS.

Oil Gas J., 65 (4):110-111, Oct. 2, 1967. 14 refs.
R. N. Maddox, and Michael D. Burns.
Identifiers: *Scrubbers, *Design criteria, *Amines, *Hydrogen sulfide, Natural gas, Absorption, Mathematical analyses, Thermodynamics, Pressure, Temperature.

Principal design problems for the stripping column of an amine natural gas sweetening plant include estimating the heat load for the reboiler, calculating the column diameter, and estimating the height, or number of trays, required for the stripping operation. The heat load on the reboiler includes the sensible heat required to raise the temperature of the feed solution to that of the regenerated solution leaving the reboiler; the heat of reaction required for the dissolution of the acid gases from the amine; and the heat of vaporization of the water leaving the stripping section of the column as vapor with acid gases. Temperatures in the stripper will be governed by the operating pressure, and the recommended maximum allowable temperature in the reboiler is 260 F for aqueous monoethanolamine regeneration. The reflux ratio for the stripper is defined as the ratio of the moles of water in the acid gas from the stripping column to the moles of acid gas stripped. Ratios from 2:1 to 3:1 have been used for aqueous MEA plants in natural gas sweetening service of hydrogen sulfide. Solution purity obtained from the stripper will be a function of the quantity of stripping vapor. Column diameter can easily be estimated using correlations based on the limiting gas velocity for tolerable liquid entrainment, and the number of trays required is generally determined on the basis of experience.
APTIC-23786

### COMPARATIVE EMISSIONS FROM SOME LEADED AND PROTOTYPE LEAD-FREE AUTOMOBILE FUELS.

Bureau of Mines, Washington, D. C., Rept. of Investigations 7390, 24p., May 1970. 9 refs.
CFSTI: PB 192004
Barton H. Eccleston, and R. W. Hurn.
Identifiers: *Automotive emissions, *Fuel additives, *Tetraethyl lead, Engine exhausts, Fuel evaporation, Gasolines, Automobiles, Gas chromatography, Flame ionization detector, Infrared spectrometry, Irradiation chambers, Aldehydes, Carbon monoxide, Nitrogen oxides, Photochemical reactions.

An investigation is reported of the effect upon automobile emissions in changing from leaded to lead-free gasolines. Typical U. S. leaded gasolines and prototype lead-free gasolines of comparable octane quality were used in eight vehicles operated to simulate city driving. The experiments were run at 70 and 95 F. Exhaust and evaporative emissions were measured and the photochemical effect of the emissions was experimentally observed in an artificial smog chamber. Results of the study reveal the manner and degree in which the changes in fuel composition alter the amount and characteristics of both exhaust and evaporative emissions. The compositional differences between leaded and prototype lead-free fuels resulted in higher photo-chemical pollution potential of the emissions from the lead-free fuels. The effect is attributed to the photochemical characteristics of high-octane fuel components that are used in greater quantity in the lead-free fuels. Emissions of carbon monoxide, oxides of nitrogen, and aldehydes were not affected significantly by the changes from leaded to lead-free fuel formula. It is emphasized that these results are not related to the effect of lead, per se. Rather, they bear on the net effect on air pollution if fuel composition were to be changed to meet fuel octane and volatility requirements without the use of lead antiknock additives. (Author abstract modified)
APTIC-23789

### ROLE OF SURFACE ACIDITY IN THE ADSORPTION OF ORGANIC POLLUTANTS.

Environ. Sci. Technol., 2 (4):291-297, April 1968.
29 refs. (Presented at the American Chemical
Society, Division of Colloid and Surface
Chemistry, Kendall Award Symposium, 155th
Meeting, San Francisco, April 1968.)
Robert W. Coughlin, and Fouad S. Ezra.
Identifiers: *Carbon black, *Adsorption, *Surface properties, Organic acids, Phenols, Aromatic hydrocarbons, Benzenes, Nitrates, Oxides, Oxidation, Reduction.

Changes are reported in adsorptive capacity of carbon adsorbents resulting from alteration of the carbon surface by chemical treatment, particularly with respect to formation and removal of acidic surface oxides. An active carbon, Columbia carbon LC325, and a pelletized channel black, Black Pearls 607, were employed in this work. The surfaces of the carbons were modified by wet oxidation and reduction, and adsorption and desorption were studied by equilibrating the carbon samples at 30 C with aqueous solutions of phenol and nitrobenzene for about 1 week. Concentrations were measured by ultraviolet spectrophotometry at 270 millimicrons, in the case of phenol, and at 267.8 millimicrons, in the case of nitrobenzene. Increased concentration of surface oxides on carbon greatly reduces the amount of phenol and nitrobenzene that can be adsorbed from dilute aqueous solution of these compounds. In the case of phenol, adsorption from aqueous solutions of higher concentration does not appear to be strongly affected by the presence or absence of acidic chemisorbed oxygen on the surface of the carbon adsorbent. This is interpreted in terms of a two-step adsorption isotherm for phenol on carbon. Alteration of the carbon surface by oxidation and reduction appears to be reversible to a large extent, as evidenced by measurements of both surface acidity and adsorptive capacity. Possible explanations for this behavior are discussed. (Author abstract modified)
APTIC-23797

### THE DOBEN PROCESS (GASOLINE DEASPHALTING OF PETROLEUM RESIDUES) AND PERSPECTIVES OF ITS INDUSTRIAL APPLICATION FOR THE PRODUCTION OF MOTOR FUELS AND FUEL OILS.

(Doben-Verfahren (Deasphaltisierung von
Erdoelrueckstaenden mittels Benzins) und
Perspektiven fuer seine grosstechnische
Anwendung zur Herstellung von
Motorkraftstoffen und Heizoelen). Text in
German. Erdoel Kohle (Hamburg), 23 (7):417-422,
July 1970. 12 refs.
Alexander S. Eugenson, Boris M. Jeshow, Georgij
A. Worms, Gerrich A. Berg, and Fatkulla Ch.
Malikow.
Identifiers: *Asphalt, *Gasolines, *Petroleum refining, Ussr, Fuel oils, Residual oils, Pilot plants, Settling chambers, Fuel oil preparation.

The Doben process treats petroleum residues in a contact chamber with straight-run gasoline (without aromatic hydrocarbons) at temperatures favoring the draining of the asphalt concentrate and at pressures which prevent the evaporation of the solvent. The process removes 93 to 96% asphaltenes and improves the properties of the residue. The Doben process demineralizes, demetallizes and decarbonizes the residues and to a degree also desulfurizes them. The properties and composition of the deasphaltisate are given. In contrast to thermocracking and coking, no unsaturated hydrocarbons are formed by the Doben process. The process has been successfully applied on a pilot plant scale in several plants.
APTIC-23805

### AIR STERILISATION AND DISINFECTION.

Process Biochem., 5 (9):21-23, Sept. 1970. 12 refs.
J. E. Firman.
Identifiers: *Microorganisms, *Control equipment, Great britain, Electrostatic precipitators, Filters, Scrubbers, Ventilation, Controlled atmospheres, Ultraviolet radiation.

Sterilisation or disinfection of air can be achieved by chemicals, heating, irradiation, scrubbing or filtration, the choice depending on individual requirements. A mixture of formalin and tap water is boiled is an electrically heated boiler in a proportion of approximately 0.5 ml formalin to 1.0 ml water/cu ft of room space. To remove the vapor after fumigation is complete, the area should be provided with a means of ventilation. Air heaters are used where the value of the end product justifies the high expenditure, although there is little doubt that heat has advantages over filtration in respect to effluent air from fermentation vessels, especially where frothing is prevalent. The main disadvantage is that in the event of a power or component failure, a condition may arise whereby the contaminated effluent air is discharged to the atmosphere. Ultraviolet sterilisation is effected by the type of organism and humidity of the air. The hot cathode type tubes are similar to fluorescent tubes and have a life of about 2500 hr during which period the UV output reduces by about 30% when used at an average 3 hr/run; the cold cathode lamp does not lose any output during the first 3000 hr of use, but gradually deteriorates over a period of 6000-10,000 hr. It is possible to destroy large airborne particles by scrubbing or washing effluent air with selected fluids for neutralizing the fumes, but small monodispersed organisms can be encased in bubbles and pass safely through the solution. Electrostatic precipitators have the main advantage of being compact in size and of offering little resistance to air flow. For ventilation systems, their main technical disadvantages for use as a sole means of filtration are that they rely on an uninterrupted supply of electric power, while very large particles and small winged insects can pass through without being arrested. There are many different types of air filters, ranging from roughing filters for the removal of large airborne particles, up to ultra-high efficiency filters which are capable of filtering out virus size particles. British methods of testing filters with methylene blue and sodium chloride test clouds are discussed, as well as selection of filters.
APTIC-23807

### LIQUID-TYPE GAS SCRUBBING EQUIPMENT.

(Assignee not given.) U. S. Pat. 3,524,302. 5p.,
Aug. 18, 1970. 17 refs. (Appl. July 17, 1968, 2
claims).
Michael M. Jalma.
Identifiers: *Bubble towers.

To promote intimate contact between gas and scrubbing liquid, many gas scrubbers are provided with moving parts. These add to the cost of the scrubbers and do not significantly increase the effectiveness of the scrubbing action. In the scrubber described, the only movable parts are the pump and the blower required for circulating the gas and liquid. Vigorous agitation and rotary circulation of the gases and scrubbing liquid are achieved by directing them toward horizontal plates having openings and deflecting means positioned above the openings. The gas to be scrubbed is introduced beneath the lowermost plate while scrubbing liquid is projected upward against the lower surface of the plate. The liquid is carried upward with the gas and through the openings in the plates, the deflecting means causing both gas and liquid to rotate and intermingle. The liquid is returned from the upper plates to a sump in the bottom of the equipment for recirculation; the scrubbed and cleaned gases pass outward from the upper portion of the equipment.
APTIC-23813

### MUFFLER.

(Assignee not given.) U. S. Pat. 3,521,429. 3p.,
July 21, 1970. 7 refs. (Appl. Oct. 4, 1968, 4 claims).
Frank B. Leffler.
Identifiers: *Mufflers, *Treated fabrics, *Automotive emission control, Engine exhausts, Par-

ticulates, Internal combustion engines, Automobiles, Trucks, Catalysis, Gases.

An improved muffler for combustion exhaust systems commonly found in automobile engines and diesel trucks removes solid particles by physical entrainment and gaseous pollutants by converting them into a chemical state considered to be noncontributing to atmospheric pollution. The muffler is an imperforate tube constructed of corrosion-resistant materials such as galvanized steel, aluminized steel, aluminum, ceramic or glass-lined metal tubes. The entire internal volume of the tube is filled with porous packing material, preferably alternating layers of glass fiber and steel wool mats. The porous packing is coated with silicone fluids having the necessary high-temperature properties. The coating helps to effect increased particulate filtration, to reduce noise, and to lower back pressures. The exhaust gases, which pass through the porous packing at a reduced velocity, appear to be converted to harmless products by a combination of temperature and catalytic action.
APTIC-23814

### METHOD AND APPARATUS FOR COOLING AND PURIFYING GASEOUS PRODUCTS OF COMBUSTION.

(Chillum Sheet Metal, Inc., Bladensburg, Md.) U. S. Pat. 3,522,000. 4p., July 28, 1970. 6 refs. (Appl. Sept. 6, 1967, 10 claims).
Leslie Junior Kinney.
Identifiers: *Incineration, *Alkaline additives, *Cooling, Combustion gases, Baffles, Screen filters, Spray towers, Ammonia, Hydroxides, Water, Temperature.

The invention provides a method and apparatus for removing fly ash, smoke, and sulfur dioxide from incinerator gases; it includes treating the gases with ammonium hydroxide. In a known process for scrubbing gases, an ammonium hydroxide spray is used in the initial cleaning stage. This procedure is of little use under conditions of incineration, where the addition of ammonium hydroxide to the high-temperature gases could cause intermediates formed by reactions between different gas constituents to react violently. Moreover, sulfur dioxide at this stage would combine with ammonium hydroxide to produce an ammonia sulfite salt that would immediately revert to the gaseous stage. The invention is based on adding ammonium hydroxide subsequent to a series of cooling and washing steps. Smoke and gases are first led to a heat exchanger comprising an air-cooled heat sink, then passed to a chamber comprising sprays, screens, and baffles. Here suspended particles are first removed from the gases and the temperature of water-soluble gases reduced to about 70 F. When this temperature is reached, the remaining gases are sprayed with ammonium hydroxide by means of which the gases form water-soluble compounds. The latter are moved by a terminal water spray.
APTIC-23815

### INSTALLATIONS HAVING BAFFLE PLATE SEPARATORS.

(Ameliorair (Societe Anonyme), Paris, France) U. S. Pat. 3,504,484. 7p., April 7, 1970. 20 refs. (Appl. Jan. 22, 1969, 10 claims).
Jean Buffet.
Identifiers: *Air conditioning equipment, *Baffles, France, Droplets.

A baffle plate separator is described which is designed to remove suspended particles, such as water droplets, from a circulating gaseous fluid. The device is particularly suited to air conditioning systems. The device consists of a number of rectangular plates, oriented parallel to the flow of the gas at the inlet of the separator. Each of the plates has surface irregularities which form a winding passage for the gas to follow. As the gas flows through, the suspended particles are forced to deposit on the walls of the baffle plates. The device is constructed in such a manner that it responds more favorably to various practical considerations, such as cleaning, than previous installations do.
APTIC-23816

### POST-COMBUSTION PURIFIER FOR THERMAL ENGINES.

(Societe Anonyme Automobiles, Citroen, Paris (France)) U. S. Pat. 3,522,702. 5p., Aug. 4, 1970. 5 refs. (Appl. Nov. 14, 1968, 11 claims).
Albert Grosseau.
Identifiers: *Engine exhausts, *Flame afterburners, *Combustion, France, Internal combustion engines, Automotive emission control, Engine design modification, Combustion air, Secondary air.

As a rule, existing exhaust-gas purifiers comprise a secondary air pump and a pipeline directing this air to an external distributing pipe extending parallel to the engine cyclinder block and provided with stainless steel branch pipe sections for injecting secondary air at the level of exhaust ports. Systems of this type are cumbersome, costly, and not adaptable to mass-produced engines. The device described avoids these inconveniences by providing a device of particularly simple design. The purifier comprises a secondary air pump connected by a supply pipeline to an air distributor communicating in turn with air injection pipes that open into pockets of the engine exhaust valve. The air distributor consists of a flat plate securely placed between the exhaust manifold and the cylinder head. The plate has holes for the passage of exhaust gas and secondary air-distributing ducts, each of which communicates on the one hand with an air injection pipe, housed in the cylinder head, and on the other hand with an air-inlet orifice connected to the secondary air supply pipeline. Because of the flat configuration of the air distributor and its location, the device can easily be adapted to a mass-produced engine. Only a simple machining operation is required to fit the air injection pipelines to a cylinder head. Cost savings are considerable because the stainless steel air-injection pipe sections are relatively short.
APTIC-23818

### FLAME GRID AND COMPONENT PARTS THEREOF.

(North American Mfg. Co., Cleveland, Ohio) U. S. Pat. 3,524,632. 27p., Aug. 18, 1970. 4 refs. (Appl. June 12, 1968, 67 claims).
Theodore E. Davies.
Identifiers: *Burners, *Incineration, *Firing methods, Evaporators, Furnaces, Combustion.

The invention relates to direct-fired, flame-grid type burners using substantially raw fuel to heat a gaseous stream such as air or gas (carrying or not carrying combustibles, including fumes, to be incinerated). The burners have structures that make them suitable for use in a make-up air heater, air space heater, oven, dryer, evaporator, draw furnace, or fume or combustible incinerator. They can handle temperature rises from 3 to 1500 F. Each burner has a long turn-down range and plate-like portions with flow opening or edge portions for diverting some stream portions into a combustion zone on a flame holder and subsequently mixing the combustion products with all air stream portions for uniform heating or incineration. In addition to having minimum initial and operating costs, the burners meet the highest incineration standards. (Author abstract modified)
APTIC-23819

### BAG AIR-FILTER.

(Delbag-Luftfilter GmbH, Berlin, Germany) U. S. Pat. 3,524,304. 4p., Aug. 18, 1970. 8 refs. (Appl. May 29, 1967, 6 claims).
Hans Joachim Wittemeier, Fritz Becker, and Klaus Peter Deutschmann.
Identifiers: *Bag filters, Germany.

Adequate sealing between the filter medium and the mounting frame is a prerequisite for the effective separation of fine dust and suspended matter. In the case of bag filters, some are sealed to receptor plates with adhesive, the consequences of which are that the plates must be changed along with the dirty bags. In addition, the adhesive connection is vulnerable, especially to bending, and the combination of plates with bags forms clumsy units. In other known arrangements, the bags are fixed exchangeably on receptor plates by means of press buttons mounted on tape. This procedure is too time consuming for large installations. The present invention avoids these disadvantages by providing the bag filters with folded over and stiffened rims and by surrounding the bag openings on the receptor plates with collars. The filters are suspended from the collars by the stiffened rims. To secure the rims to the bags, a retaining plate is proveded, the openings of which are larger and the collars of which are of less depth than those of the receptor plates. In this way grooves are formed around the collars of the receptor plates. The folded-over rims of the filter bags are fixed in the grooves, which prevents their being dislodged. The individual bags are exchangeable and no special precautions are needed for sealing insertion.
APTIC-23820

### EXHAUST BACK PRESSURE CONTROL SYSTEM FOR AN INTERNAL COMBUSTION ENGINE.

(Ethyl Corp., New York) U. S. Pat. 3,523,418. 5p., Aug. 11, 1970. 4 refs. (Appl. Oct. 7, 1968, 3 claims).
Frederick J. Marsee.
Identifiers: *Back pressure, *Throttling, *Engine exhausts, *Control methods, *Hydrocarbons, Internal combustion engines.

Among systems for controlling exhaust back pressure in internal combustion engines, one is responsive principally to the heat of the exhaust and is operative only while the engine is warming up. Another system is responsive to manifold vacuum and is operative while the engine is idling or operating under a particularly small load. The latter system will not operate without a mechanical linkage to the engine accelerator. If the linkage breaks down, the vacuum control units holds the back pressure throttline element closed and thus results in engine stalling. The present invention provides a device that is responsive to back pressure and is controlled directly by the engine; no mechanical linkage is required. The throttling element is placed in the exhaust pipe and is controlled by a vacuum operator unit, which in turn is modulated by a sensing unit responsive to both the engine vacuum and exhaust back pressure. The sensing element provides a vacuum signal to the vacuum operator unit to control the throttline element during lower-power engine operation. There is no danger that exhaust gas flow will be throttled at high-power engine operation, since the velocity of the gases coupled with a spring operator is sufficient to overcome any vacuum signal from the engine. In a preferred embodiment, no throttling of the exhaust gas occurs at idle. The system also effects a reduction in unburned hydrocarbons. Emission reduction figures are given for standard V8 engines.
APTIC-23821

### SYSTEM FOR REMOVAL OF SO2 AND FLY ASH FROM POWER PLANT FLUE GASES.

(Universal Oil Products Co., Des Plaines, Ill. and Wisconsin Electric Power Co., Milwaukee, Wisc.) U. S. Pat. 3,520,649. 7p., July 14, 1970. 4 refs. (Appl. Sept. 28, 1967, 10 claims).
James P. Tomany, and Wilfred A. Pollock.
Identifiers: *Stack gases, *Fly ash, *Alkaline additives, Coal, Steam plants, Scrubbers, Absorption (general), Carbonates, Calcium compounds, Magnesium compounds, Sulfates, Sulfites.

A sulfur dioxide and fly ash removal system for coal burning power plant stack gases is described. The system provides for limestone-dolomite addi-

tion to the coal carrying through the power plant to form stable sulfate-sulfite compounds and unstable calcium and magnesium oxides which will carry along with the fly ash particles to a scrubbing zone. The fly ash and the sulfate-sulfite compounds are countercurrently contacted with a descending alkaline scrubbing stream in the presence of self-cleaning mobile contact elements in the scrubbing zone to effect the absorption of SO2 and physical removal of fly ash and the stable sulfate and sulfite materials. The continuously circulating alkaline stream used in the scrubbing zone is obtained in part from the reaction of portions of the calcium and magnesium carbonates and oxides from the limestone-dolomite addition, with recirculating water. The advantages of this system over previous ones are that it removes fly ash as well as SO2, which wet scrubbers often do not do; it utilizes low-cost naturally occurring materials; and it has a high degree of efficiency. (Author abstract modified)
APTIC-23822

### ELECTROSTATIC AIR CLEANER AND CONTROL MEANS THEREFOR.

(Assignee not given.) U. S. Pat. 3,504,482. 6p., April 7, 1970. 15 refs. (Appl. Jan. 22, 1965, 7 claims).
William H. Goettl.
Identifiers: *Electrostatic precipitators, Domestic heating, Air conditioning equipment, Ozone, Electric charge.

The generation of ozone by electrostatic precipitators can cause dangerous local conditions if the ozone is not continuously swept away by the air flow through the unit. A precipitator is described which includes a flow-sensing mechanism to deenergize the precipitator if the air flow becomes too low. A novel means is provided for grounding the static charge when the unit is moved relative to a supporting frame for service. The unit can form a return grill for the inlet of an air flow return duct of an air conditioning system which has its inlet communicating with the interior of a building room. Prior installations rely upon controlling the precipitator by coupling it in an expensive way with the blower motors of the heating or air conditioning units. Also, the prior installations are not as effective in removing ozone buildups. The device described here exhibits advantages in both of these functions over other types of electrostatic precipitators.
APTIC-23823

### MEANS FOR CARRYING OUT GAS SCRUBBING OPERATIONS.

(John Pirie Brander Stuart, Johannesburg (South Africa)) U. S. Pat. 3,524,631. 4p., Aug. 18, 1970. 10 refs. (Appl. Nov. 6, 1967, 11 claims).
Ernest Mare.
Identifiers: *Scrubbers, *Design criteria, Africa, Condensation, Flow rates, Heat transfer, Liquids.

A method and apparatus for scrubbing gas including the operations of heat exchange, evaporation, and condensation are described. The gas is directed downward onto the surface of a liquid reservoir in such a manner as to entrain liquid droplets in the gas stream. The liquid/gas stream forms a vortex around the inlet pipe and under the atomizing shield surrounding the inlet pipe. The combined actions of atomization of the liquid and the vortex motion provide the intimate mixing necessary for efficient scrubbing. Flow rate and liquid level are manipulated to obtain steady state conditions and eliminate surges.
APTIC-23824

### SCRUBBING NOZZLE FOR REMOVING UNCONVERTED CARBON PARTICLES FROM GAS.

(Texaco Development Corp., New York) U. S. Pat. 3,524,630. 6p., Aug. 18, 1970. 3 refs. (Appl. July 1, 1968, 4 claims).
Charles P. Marion.
Identifiers: *Suspended particulates, *Venturi scrubbers, *Design criteria, Fluid flow, Gases.

A scrubber nozzle for removing carbon particles from a gas stream is described. The nozzle is inserted in a gas line at a coupling and is connected to a supply of scrubbing fluid (water is the scrubbing fluid used illustratively) which is injected into the gas flow at considerable velocity and in such a manner as to impart radial motion to the gas stream. The scrubbing fluid is atomized by the injection nozzle and the resulting mist entrains suspended particulate matter and promotes its agglomeration. No details are provided as to the manner of removal of the wash fluid and the agglomerated particulates from the gas stream except by reference to another patent.
APTIC-23825

### FILTER STRUCTURE AND METHOD OF MAKING THE SAME.

(Assignee not given.) U. S. Pat. 3,524,303. 15p., Aug. 18, 1970. 10 refs. (Appl. Sept. 13, 1968, 28 claims).
Edgar S. Stoddard.
Identifiers: *Air conditioning equipment, *Filter fabrics, *Design criteria, Domestic heating, Filters, Electrical properties, Voltage, Temperature.

A self-cleaning filter for heating and air conditioning applications is described. The filter element is constructed of warp fibers that are electrically insulating and thermally stable to about 1000 F. The woof consists of alternate cords of the same or a similar material as used in the warp and an electric heating element. The filter element is rigidized by a frame of epoxy or an equivalent non-conducting, thermally stable material on which is mounted the fastening fixtures for the filter element and the necessary electrical connections. The filter frame would also contain the necessary mounting attachments to mechanically fasten the filter frame to its appliance housing through a gasket designed to direct the total air flow through the filter element. The filter is designed to clean itself by heating the material on the filter to between 700 and 1000 F and either burning or volatilizing the trapped material. Variations of the system include multiple filter elements operating at the same or different temperatures and timing devices to control the energizing of the heating element.
APTIC-23826

### HEAT TRANSFER APPARATUS UTILIZING PARTICLES OF GRANULAR MATERIAL.

(Assignee not given.) U. S. Pat. 3,524,633. 9p., Aug. 18, 1970. 5 refs. (Appl. July 24, 1968, 16 claims).
Benjamin P. Shiller.
Identifiers: *Stone, *Particulates, *Afterburners, Surface coatings, Fumes, Solvents, Incineration, Design criteria, Combustion, Heat transfer.

An apparatus in the general configuration of a sand blasting unit using heated sand is used to strip coatings off workpieces. The sand bed is fluidized by air blown under it in such a manner as to cause particles of sand to be blown through flame jets over the bed. The hot sand ignites any combustible fumes or material stripped from the workpiece, providing an essentially completely burned exhaust fume. Mechanical variations permit batch or continuous processing. Another use for the device is the incineration of combustible material such as paint booth overspray where the material is ignited by the hot particles of sand in the same manner as stripped coatings are ignited. The primary function of the device is to transfer heat to the workpiece.
APTIC-23827

### AIR FILTER WITH FLUIDIC TIMING MECHANISM.

(K-B Engineering Co., Wichita, Kans.) U. S. Pat. 3,521,430. 11p., July 21, 1970. 6 refs. (Appl. May 20, 1968, 14 claims).
Herbert D. Vanderlip, and Jack W. Kice.
Identifiers: *Fluidic timing mechanism, *Bag filters, *Design criteria, Dusts, Flour processing, Pressure.

A filter system is described that reverse flushes itself in such a manner as to make its use suitable for explosive atmospheres. The system consists of a baghouse with a large volume, low pressure air reservoir mounted external to the baghouse. The reservoir is connected to the filter bag system in a manner to permit reverse flushing. Flushing is initiated when the pressure, as sensed by a diaphragm in the reservoir, reaches a predetermined level. The use of low pressure air prevents the accumulation of oil fumes in the air which tend to degrade the performance of the filter system and increase the frequency of bag replacement. Air operated valving sequentially selects a group of bags for reverse flushing at each air release. The absence of any electrical devices within the baghouse permits safe operation of this system in the normally explosive atmosphere of a flour mill or similar dust hazard area.
APTIC-23828

### METHOD AND APPARATUS FOR COMBUSTING INTERNAL COMBUSTION ENGINE EXHAUST POLLUTANTS.

(Assignee not given.) U. S. Pat. 3,524,316. 5p., Aug. 18, 1970. 6 refs. (Appl. July 31, 1968, 10 claims).
Joseph W. McKee.
Identifiers: *Spark timing, *Design criteria, Engine exhausts, Blowby, Crankcase ventilation air, Spark ignition engines, Automotive emission control.

A method and apparatus are described for combusting the unburned gases in the exhaust of an internal combustion engine. Various devices have been proposed in attempts to minimize the quantity of pollutants which produce smog. One device is intended to prevent only crankcase fumes and blowby from entering the atmosphere, not preventing the emission of other obnoxious exhaust gases, and also contributing to engine malfunctions. In the present invention, a plurality of spark plugs, equal to the number of cylinders of an internal combustion engine, are disposed at spaced optimum positions relative to an engine afterburner and are fired in a desired sequence by a separate ignition system which operates in synchronism with the engine ignition system. An optional feature includes the provision of a moveable tail pipe which may be oriented when desired to a deicing position in which hot exhaust gases may be directed onto snow or ice on a roadway.
APTIC-23829

### EXHAUST GAS CONTROL.

(Assignee not given.) U. S. Pat. 3,520,131. 9p., July 14, 1970. 7 refs. (Appl. March 4, 1968, 14 claims).
Southwick W. Briggs.
Identifiers: *Venturi scrubbers, *Automotive emission control, *Design criteria, Engine exhausts, Spark ignition engines, Firing methods, Hydrocarbons, Carbon monoxide.

An improved workable apparatus is described for reducing the pollution emitted by exhaust gases of motor vehicles to not more than 50 ppm of unburned hydrocarbons and 0.5% carbon monoxide. A pulse venturi pump is provided for introducing a controlled flow of outside air into the hot exhaust gases of an internal combustion engine. The pulse pump comprises a pair of closely spaced-apart, thin orifice plates disposed transversely across the flow path of the exhaust gases. Each of the plates includes one or more orifice openings substantially smaller than the flow area in the exhaust conduit, whereby the exhaust gases are accelerated to high velocity as they flow through pairs of aligned openings in the spaced orifice plates. The orifice plates are constructed of thin, heat resistant material, and are maintained in a temperature range high enough to support and initiate com-

bustion of the unburned components, even though the engine is idling or operating in a low power range.
APTIC-23830

### TURNTABLE APPARATUS FOR DUST AND FUME REMOVAL FROM A WORKPIECE.

(Warren Pumps, Inc., Warren, Mass.) U. S. Pat. 3,520,278. 3p., July 14, 1970. 5 refs. (Appl. Jan. 15, 1968, 5 claims).
Elliott H. Blackwell.
Identifiers: *Turntable, *Dusts, *Fumes, *Control equipment, Metal fabricating and finishing, Collectors, Design criteria.

A turntable mechanism is described having means for removing dust and fumes produced during the treatment of a workpiece, such as flame spraying of metallic or non-metallic coatings, sand blasting or grinding. The apparatus comprises a turntable with a hole in the center for removing and collecting the by-products of the spraying operation, a drive for rotating the turntable, a traveling head mounted on a vertical column having a motor or hand operated lead screw for raising and lowering the head, and a metal spray gun and coating material mounted on the traveling head. To further facilitate the removal of dust and fumes resulting from the flame spraying operation, the turntable is mounted on a suction box which is connected to a suction pump for withdrawing dust and fumes through the hole in the turntable.
APTIC-23831

### TUNED EXHAUST GAS SYSTEM FOR OUTBOARD MOTOR.

(Outboard Marine Corp., Waukegan, Ill.) U. S. Pat. 3,520,270. 5p., July 14, 1970. 6 refs. (Appl. May 29, 1968, 13 claims).
George E. Miller.
Identifiers: *Outboard motor, *Engine design modification, Engine exhausts, Power sources, Design criteria.

A method is described which relates to maximizing the horse power output of an outboard motor having an exhaust gas passage which comprises a tube located in a drive shaft housing in spaced relation such that the exhaust gases are normally prevented from contacting the outer walls. Enlargement of the lower part of the exhaust gas tube in relation to the upper part serves to produce, in response to exhaust gas flow, negatively reflected pressure waves which arrive at the engine cylinder at about the time when the piston is at bottom dead center, and thereby provides improved scavenging of the burnt combustion gases. (Author abstract
APTIC-23832

### PROCESS FOR REMOVING DUST FROM HOT DUST-LADEN GASES.

(Assignee not given.) U. S. Pat. 3,518,812. 4p., July 7, 1970. 4 refs. (Appl. July 10, 1968, 8 claims).
Ernest L. Kolm.
Identifiers: *Stack gases, *Evaporators, Steel, Dusts, Suspended particulates, Basic oxygen furnaces, Electric furnaces, Open hearth furnaces, Oxygen lancing, Spray towers, Venturi scrubbers, Design criteria, Humidity, Condensation, Heat transfer, Cooling, Temperature.

Suspended solid particles in a hot gas are removed by a process which consists of humidifying the gas to just as near 100% saturation as possible while maintaining the temperature of the gas, condensing the liquid in the humidified gas by reducing the temperature to substantially below the dew point, and collecting the liquid and discharging it to a slurry. This method is particularly designed for the removal of dust such as is discharged by chimneys of basic oxygen furnaces, electric steel processing furnaces, and oxygen lanced open hearth steelmaking processes. The process may consist of a direct contact evaporator, a primary cooling chamber, and a secondary cooling chamber. Equipment used for the evaporator may be any conventional spray tower, venturi, or orifice type wet scrubbing equipment. (Author abstract modified)
APTIC-23833

### EXTENDED DISCHARGE SYSTEMS FOR ELECTROSTATIC PRECIPITATORS.

(Airetron Engineering Corp., Midland Park, N. J.) U. S. Pat. 3,518,813. 4p., July 7, 1970. 8 refs. (Appl. Sept. 4, 1968, 7 claims).
Hermann C. Werner.
Identifiers: *Electrostatic precipitators, *Design criteria, Collectors, Fluid flow.

An extended discharge system for electrostatic precipitators is described, wherein a plurality of discharge electrodes are interposed between a plurality of spaced collector plates. By adding further discharge electrodes and collection plates downstream of the initial apparatus, particles which had previously escaped or never reached the collection plates can now be retained. The further discharge electrodes are adapted to produce a directional electrostatic field extending substantially in the direction of flow of the fluid. They are formed with a plurality of sharp edges or points on the side in the direction of the flow while being free from sharp edges on the other side.
APTIC-23834

### AIRFLOW CONTROL FOR A DUST-FREE BENCH.

(Smith (A. O.) Corp., Milwaukee, Wis.) U. S. Pat. 3,518,814. 3p., July 7, 1970. 13 refs. (Appl. March 28, 1967, 3 claims).
John T. Maynard.
Identifiers: *Fans (blowers), *Thermistors, *Flow rates, Dusts, Filters, Design criteria.

A dust-free bench is described, which comprises a working surface and a lower enclosed housing defining an air passageway for movement of air upwardly through a filter and the work area. A variable speed motor operated fan is controlled by a speed control circuit which includes a thermistor mounted to sense the velocity of the discharged air from the filter. Change in flow results in a proportionate change in the resistance of the thermistor which is connected to actuate a unijunction oscillator. Thus, a change occurs in the firing of a 'Triac' or other solid state switching device, connected in series in the motor energizing circuit to vary the speed of the motor. The motor speed is therefore changed to maintain a constant air flow at the output side of the filter. (Author abstract)
APTIC-23835

### SMOKELESS AND ODORLESS DOMESTIC INCINERATORS.

(Calcinator Corp., Bay City, Mich.) U. S. Pat. 3,527,177. 7p., Sept. 8, 1970. 7 refs. (Appl. Jan. 4, 1968, 12 claims).
Phillip G. LaRue.
Identifiers: *Multiple chamber incinerators, *Design criteria, Stack gases, Odors, Smokes, Solid waste disposal, Odor counteraction, Excess air, Ventilation, Combustion.

An incinerator for the smokeless and odorless burning of domestic rubbish is described. The offgases of the primary combustion chamber are channeled into the path of a torch-like burner where they are heated to an elevated temperature, mixed with additional oxygen, and forced to take a definite time-delay path in order for recombustion to take place before the gases are vented to the atmosphere. A venting mechanism is provided which reduces the temperature of the gases from the secondary chamber before they are released to the atmosphere. The incinerator is of a compact and efficient design and utilizes a minimum number of parts.
APTIC-23836

### DUST COLLECTOR IMPROVEMENT.

(Ashland Oil and Refining Co., Inc., Houston, Tex.) U. S. Pat. 3,520,109. 5p., July 14, 1970. 9 refs. (Appl. Sept. 12, 1968, 6 claims).
Eddie K. Caskey.
Identifiers: *Collectors, *Bag filters, *Design criteria, Carbon black, Corrosion, Stack gases, Particulates, Humidity, Condensation, Temperature.

An improved method for collecting carbon black or other finely divided solids from a gaseous stream is described. The hot gaseous effluent containing the particulates is passed through a filter baghouse, from which it emerges clean but still hot. The hot gas is then directed around the collection hopper where the previously trapped carbon is contained. The use of the high temperature clean gas to maintain the temperature of the collection hopper above the dew point of the atmosphere within the collection hopper prevents the formation of condensate therein, and the resultant caking and corrosion associated with it. Previous processes often allow condensation to take place in the hopper, causing caking and corrosion. The process described eliminates these problems.
APTIC-23837

### ATOMIC ENERGY DUST TRAPPING DEVICE.

(Marjorie Kingston, Flushing, N. Y. and Linda Heilman, Rye, N. Y.) U. S. Pat. 3,526,080. 3p., Sept. 1, 1970. 18 refs. (Appl. April 5, 1965, 6 claims).
Alexander M. Senkewich.
Identifiers: *Nuclear power sources, *Electrostatic precipitators, *Design criteria, Dusts, Electric charge.

Dust of any composition found suspended in air has its own static charge of one or another polarity. This dust will tend to settle on any object charged with opposite polarity by an electric current. A trapping device which operates on this principle and is charged by a high voltage atomic generator is described. The device consists of a frame containing two rows of evenly spaced wires, one on each side of the frame. One row of wires is charged positive, and the other negative. The atomic generator which supplies these charges is described in detail. The dust, which is attracted to the wires, can be removed by a common vacuum cleaner or by switching the polarity of the wires and allowing the dust to fall into a collecting bag.
APTIC-23838

### APPARATUS FOR REMOVING DUST FROM GASES.

(Assignee not given.) U. S. Pat. 3,526,082. 7p., Sept. 1, 1970. 6 refs. (Appl. June 27, 1968, 13 claims).
Jean Louis Edouard Thuillier.
Identifiers: *Centrifugal separators, *Scrubbers, *Design criteria, France, Stack gases, Dusts.

An apparatus for removing dusts from gases is described. The device consists of a case which imparts a giratory motion to the gas and then directs it into a wall of dust-removing water that is travelling concentrically but in the opposite direction as the swirling gas. Means are provided to constrain the gas to pass through the wall of water. Very thorough dust removal is achieved by the double effect of centrifugal force exerted directly on the dust and the direct contact of the gas with the wall of water.
APTIC-23839

### GAS PURIFICATION.

(Assignee not given.) U. S. Pat. 3,526,081. 6p., Sept. 1, 1970. 37 refs. (Appl. June 14, 1966, 5 claims).
Wilhelm Kusters.
Identifiers: *Electrostatic precipitators, *Design criteria, Germany, Stack gases, Particulates, Oxidation, Flow rates, Corona.

An electrostatic precipitator-type of control device for gas purification is described. The device utilizes concentric electrodes within a chamber designed to impart a spiral path to the gas to be treated. The spiral path causes the gas to have a greater contact time than a straight path would cause. A corona discharge is induced between the electrodes, causing the gaseous components to be oxidized and the solid particle contaminants to be electrostatically precipitated. The advantage of this type of unit over previous ones is that the longer contact time due to the swirling motion imparted to the gas allows for greater efficiency than a straight-thru path would allow.
APTIC-23840

### RECOVERY OF SULFUR FROM GASEOUS PRODUCTS OF COMBUSTION.

(Il ricupero del solfo dai gas della combustione).
Text in Italian. Chim. Ind. (Milan), 19(10):574-578, 1937. 23 refs.
I. M. Secchi.
Identifiers: *By-product recovery, *Sulfur oxides control, Italy, Combustion gases, Primary metallurgical processing, Desulfurization of fuels, Adsorption (general), Alkalized alumina (adsorption), Titanium compounds, Oxides, Silicon compounds, Sulfur compounds.

The annual emission of sulfur dioxide from metallurgical plants is 4 million tons, the sulfur content of which, released into the atmosphere, exceeds the combined annual production of sulfur by the state of Texas and the Sicilian mines. The recovery of sulfur is reviewed from the standpoint of process for desulfurizing fuel and of dry and wet processes for the recovery of S from waste gases. Among the fuel desulfurizing processes mentioned are the Orkla process of Norwegian origin and processes proposed by Rosener and Boliden. Dry processes include absorption with silica gel and titanium dioxide. The wet processes include the Katasulf, Sulfidin, and ICI (alumina) processes. The four last-mentioned processes are discussed in detail.
APTIC-23844

### TESTS OF ADDITIVES TO CONTROL SOOT DEPOSITION IN OIL-FIRED BOILERS.

Bureau of Mines, Washington, D. C., Rept. of Investigations 5947, 19p., 1962. 15 refs.
George L. Hopps, A. A. Berk, and J. F. Barkley.
Identifiers: *Deposition, *Soot, *Boilers, *Fuel additives, Fuel oils, Temperature.

The use of fuel additives to control soot deposition in oil-fired boilers was investigated. Various chemicals, including compounds of copper and lead, were added to a mixture of No. 2 and No. 6 fuel oils that was fired in an experimental furnace. Tests were made to determine the effectiveness of these chemicals in removing soot deposits on probes devised to simulate heat-transfer surfaces in boiler and the effectiveness of the chemicals in preventing the deposition of soot on the probe surface. Test conditions were regulated so that the temperature of the products of combustion adjacent to the probes was in the range of 625 to 700 F. The clean-metal temperatures of the air-cooled probes were comparable with the water-tube temperatures in boilers operated at 40 to 100 psig. The dosages of the fuel oil additives used in these tests were generally larger than those usually recommended for most proprietary compounds. The results of the investigation were not conclusive. Under the experimental conditions that were employed, reproducibility of test data was poor. Consequently, the data do not provide a basis for rating or comparing the effectiveness of the several additives used in this work. The only statement that can be made with any degree of certainty is that none of the additives prevented the formation of soot deposits on the probes. Deposition from flue gas at a temperature higher than 700 F was not investigated. (Author abstract modified)
APTIC-23846

### ADSORPTION OF A GAS MIXED WITH AN AIR STREAM.

Kolloid-Z. (Germany), vol. 49:288-296, 1929. 5 refs. Translated from German by J. C. Arnell, Defence Research Chemical Labs., Ottawa (Ontario), 20p., Feb. 1954. CFSTI, DDC: AD682875
N. Schilow, L. Lepin, and S. Wosnessensky.
Identifiers: *Charcoal, *Adsorption, *Chlorine compounds, Ussr, Packed towers, Flow rates, Gases.

The distribution of the chlorine adsorbed by a carbon adsorbing bed from an air stream, as well as the distribution of the residual chlorine in the gas phase along the same bed in a specially constructed apparatus was studied. The dependence of the service time on the length of the adsorbing bed is expressed by two empirical quantities. These quantities permit the definition of the adsorption properties of a bed under fixed experimental conditions and the calculation of the service time for different bed lengths under the same conditions. The adsorption capacity of the charcoal section in the direction of the stream remains partially unused. This plays an essential part when the efficiency of a given quantity of adsorbent is considered. The concentrations of the chlorine remaining in the gas phase inside the charcoal section will decrease regularly from the initial concentration at the entrance of the apparatus to zero at the point where the chlorine no longer appears because of complete adsorption.
APTIC-23850

### A SUBMICRON PARTICLE PRECIPITATOR BASED ON WATER VAPOUR CONDENSATION.

International Atomic Energy Commission, Vienna (Austria), Treat. Airborne Radioact. Wastes, Proc. Symp., New York, 1968, p. 541-550. 6 refs. (Aug. 26-30.)
C. Melandri, V. Prodi, O. Rimondi, and G. Tarroni.
Identifiers: *Nucleation, *Particle growth, *Aerosols, *Gravity settling, Deposition, Italy, Particle size, Design criteria, Condensation, Flow rates, Vapors, Wetting, Electric charge.

An aerosol particle precipitator is described which consists basically of a gap where a strong water vapor concentration gradient and supersaturation are established. The main mechanism causing precipitation is particle nucleation and growth which greatly enhances the settling velocity under gravity. The effects of flow rate and particle concentration at the inlet are studied. The parameter ruling the deposition efficiency is the amount of water available to each particle. The contributions of thermophoretic, diffusiophoretic, and gravitational forces are also evaluated. The tests are performed with DOP (dioctylphthalate) smoke and with the aid of an aerosol photometer. The collection efficiency under specific operating conditions is better than 99.97%. Since the aerosol produced by the smoke generator is heavily charged, a charge neutralizer is employed which improves the performance of the precipitator. (Author abstract modified)
APTIC-23855

### FABRIC FILTRATION OF FLUE GASES FROM AN ACTIVE INCINERATOR: STUDIES ON DESIGN OPTIMIZATION AND OPERATIONAL ANALYSIS.

International Atomic Energy Agency, Vienna (Austria), Treat. Airborne Radioact. Wastes, Proc. Symp., New York, 1968, p. 623-644. 1 ref. (Aug. 26-30.)
A. A. Khan, R. V. Amalraj, and K. T. Thomas.
Identifiers: *Incineration, *Bag filters, *Filter fabrics, Costs, Ash, Stack gases, Aerosols, Operating variables, Pilot plants, Design criteria, Radioactive radiation.

The use of bag filters in the dry gas cleaning system of an incinerator is a safe and economical method for treating the flue gas from an incinerator burning low-level radioactive solid combustibles. A study designed to gather operational data which is directly applicable to the design of fabric filtration units for industrial plants is described. Various types of fabrics, including cotton, terylene, wool, dacron, and glass, are evaluated to find the filtration characteristics during the entire cycle of operation. Data on pilot plant studies carried out to optimize a suitable design of fabric filter for flue gas cleaning is included. Cost comparisons of different fabrics based on the life of the fabric and the cost of the fabric filtration per unit of solid waste treated are given. The physical, chemical, and radiochemical nature of the aerosols encountered in various parts of the incinerator system are described. (Author abstract modified)
APTIC-23856

### COMPARISON OF HOPCALITE AND A SUPPORTED HOPCALITE FOR APPLICABILITY TO SUBMARINE USE.

Naval Research Lab., Washington, D. C., Fuels Branch, NRL Problem 61C08-18.203, Proj. SF 354330012-13213, NRL-MR-2105, 22p., April 1970. 6 refs. CFSTI, DDC: AD 707335
F. S. Thomas, J. K. Musick, and J. E. Johnson.
Identifiers: *Catalysts, *Hopcalite, *Catalytic oxidation, Ships, Exhaust systems, Ventilation, Hydrocarbons, Hydrogen, Aluminum compounds, Manganese compounds, Carbon monoxide, Catalytic activity.

In conjunction with a study on criteria for the selection of oxidation catalysts for use in air purification in nuclear submarines, several catalysts are investigated with regard to suitable physical properties and catalytic activity. The presently used Hopcalite catalyst is compared with a supported Hopcalite catalyst with an alumina base. The supported Hopcalite, expected to be superior in terms of higher crush and abrasion resistance, and catalytic properties, due to its larger surface area, proved to be superior only in crush resistance. Catalytic activity for carbon monoxide, hydrogen, and hydrocarbons is much lower than that of Hopcalite. This, plus the smaller reserve catalytic capacity as compared to Hopcalite, makes the use of the supported Hopcalite undesirable as a replacement for the present material.
APTIC-23861

### PROCESS FOR THE MANUFACTURE OF SULFUR.

(Verfahren zur Herstellung von Schwefel). Text in German. (Farbenindustrie (I. G.) A.-G. Frankfurt, Germany) Ger. Pat. 670,884. 2p., Jan. 5, 1939. (Appl. June 5, 1936, 2 claims).
Hans Dohse, and Herbert Wolf
Identifiers: *Reduction, *By-product recovery, *Sulfur oxides control, Germany, Combustion gases, Sulfur dioxide, Sulfur compounds, Hydrogen sulfide, Catalysts.

A process is presented for reducing the oxides of sulfur by means of a carbon-containing solid, in which the gases remaining after the removal of most of the elemental sulfur are brought in contact with the reducing agent at a normal or a slightly raised temperature. This process can also take place in the presence of materials that favor a reaction between sulfur dioxide and hydrogen sulfide (or some other compound containing sulfur and hydrogen).
APTIC-23863

### SULFUR AND ITS EFFECT UPON COAL UTILIZATION.

In: Report of Bituminous Research Activities. Pennsylvania State Univ., University Park, Dept. of Fuel Technology, Serial No. 57 Appendix p. 1-12, 1956. 5 refs.
T. S. Spicer.
Identifiers: *By-product recovery, *So2 removal (combustion products), Costs, Combustion gases, Stack gases, Coal characteristics, Fuel gases,

Desulfurization of fuels, Coal preparation, Sulfuric acid.

Sulfur in coal is discussed with respect to its occurrence and its affects on the production of coke, steel, steam, and fuel gas all of which are deleterious. The removal of sulfur from coal during coal preparation is covered by the two statements: 'The only practical way to reduce the sulfur content of coal is by washing' and 'The sulfur content of this coal was actually increased by cleaning.' By-product recovery of sulfur from flue gas is considered the only way to meet air pollution control requirements. By-product recovery of sulfur is also considered as a means of reducing the cost of desulfurization of producer's gas. High-pyrite residue from coal cleaning plants is mentioned as a potential raw material for sulfuric acid production, but short hauling distances, favorable freight rates, and a sulfur content in excess of 45% would be required to make the scheme economically attractive.
APTIC-23867

### DESULFURIZATION OF EXHAUST COMBUSTION GAS BY LIME INJECTION METHOD (II).

(Source Not Given). p. 657, 1969 (°). Translated
from Japanese. Franklin Inst. Research Labs.,
Philadelphia, Pa., Science Info. Services, 3p.,
Nov. 18, 1969.
Kusuyata Tanaka, Atsumu Sakabe, So Kawai,
Shinzo Hirasawa, and Kunio Miyajima.
Identifiers: *Absorption (general), *Temperature, Japan, Stack gases, Mathematical analyses, Hydroxides, Calcium compounds.

The lime injection process for desulfurizing combustion gas was investigated at 850, 1000, 1050, and 1100 C with gas containing 22% sulfur dioxide and 3% oxygen. Absorption of SO2 by calcium hydroxide was highest at 1050 C, when the equilibrium constant was calculated to be 6.7. The relationship between apparent equilibrium constant and temperature is graphically illustrated for each reaction temperature, as is the relation between the desulfurization rate and volume of calcium hydroxide at the time of equilibrium. To obtain a desulfurization rate of 50% when 02 is 3% and SO2 is 0.20%, it is sufficient to inject calcium hydroxide at 2.1 times the theoretical weight.
APTIC-23872

### ABSORPTION OF SULFUR COMPOUND IN EXHAUST GAS BY LIMESTONE.

(Source Not Given). p. 397, 1969 (°). Translated
from Japanese. Franklin Inst. Research Labs.,
Philadelphia, Pa., Science Info. Services, 3p.,
Nov. 18, 1969.
Kusuyata Tanaka, Tsuyoshio Yamada, Atsumi
Sakabe, So Kawaii, and Kunio Miyajima.
Identifiers: *Temperature, *Absorption (general), Japan, Stack gases, So2 removal (combustion products), Carbonates, Calcium compounds.

Experiments were conducted in an electric furnace to determine optimum temperatures for the absorption of sulfur dioxide by calcinated limestone. The absorption rate was highest when the limestone was calcinated at 1100 C and sulfur dioxide absorbed at 900 C. At the latter temperature, the amount of SO2 absorbed per 100g absorbent is 24.68g.
APTIC-23873

### FLUE-GAS WASHING PROCESSES. PART ONE.

Power Works Eng., vol. 41:17-21, 25, Jan. 1946. 2
refs. PART II. Ibid., vol. 41:37-40, Feb. 1946.
PART III. Ibid., vol. 41:75-77, March 1946. PART
IV. Ibid., vol. 41:103-105, April 1946.
W. Francis.
Identifiers: *Electric power production, *Packed towers, *Catalytic oxidation, *Alkaline additives, Great britain, Stack gases, Design criteria.

Battersea was the first large power station in Great Britain required to install a flue-gas washing plant to remove the sulfur oxides and other strong acid constituents at a high efficiency. The commercial process consists of washing the gases, first with natural river water in contact with rusty steel packing, then with river water containing in suspension additional alkali in contact with wooden packing. The rusty steel packing in the first scrubbers acts as a catalyst to promote the solution and oxidation of the sulfur dioxide, and it slowly dissolves and the iron in solution acts as a catalyst to promote oxidation in the subsequent aeration process. Additional alkali is added in a separate scrubber to remove the last traces of sulfur oxides. In the non-effluent system used at Fulham, no liquid is passed back to the river or drain. The washing medium passes down scrubbers containing suitable packing materials, and the hot flue gases pass upwards through the scrubbers. The sulfur oxides removed are neutralized by an alkali which forms a precipitate. This may be removed, together with the dust and grit washed from the gases, by settlement or filtration. Problems of designing the non-effluent plant are discussed.
APTIC-23879

### NAPCA'S SEARCH FOR FLUE GAS DESULFURIZING PROCESSES.

Preprint, 22p., 1969 (°). (Presented at the Gordon
Research Conference, Aug. 18-22, 1969.)
L. Stankus.
Identifiers: *Sulfur oxides control, *Nitrogen oxides, *Research programs, *Federal governments, Control agencies, Costs, Stack gases, Natural gas, Electric power production, Scrubbers, By-product recovery, Catalytic oxidation, Excess air, Gasification (synthesis), Absorption (general), Alkaline additives, Nitric acid, Sulfuric acid, Hydroxides, Vanadium compounds, Oxides, Nitric oxide (no), Nitrogen dioxide (no2), Silicon compounds, Sulfides, Catalysis, Chemical reactions, Reduction, Combustion.

The National Air Pollution Control Administration's work on sulfur oxides and nitrogen oxides control is summarized by briefly stating the scope of major investigations, showing principal concepts generated, and indicating present achievements and possible future developments. There are several methods for desulfurizing flue gases under investigation, such as ammonia scrubbing and aqueous scrubbing. Organic liquids, such as olefins, carbohydrates, and amines, appear promising for extracting sulfur dioxide from flue gas. Solid organic materials including newsprint, sawdust, and cotton are capable of absorbing SO2. The most suitable catalyst for oxidizing SO2 to SO3 is vanadium pentoxide. Several methods for reducing SO2 to elemental sulfur were also investigated. Coal gasification was studied as a method for eliminating the varous forms of sulfur contained in coal. Methods for reducing nitrogen oxides emissions include catalytic reduction, staged combustion, and fuel combustion with oxygen. Combustion with low excess air, steam or water injection into the fuel burning zone, and flue gas recirculation into the fuel-air mixture were also investigated. A study on the availability and use of natural gas as a sulfur-free fuel for power generation was conducted. The principal chemical reactions that occur with these control methods are included.
APTIC-23880

### PRACTICAL EXPERIENCE WITH THE CONTROL OF OIL BURNERS FOR THE REDUCTION OF SOOT EMISSIONS AND ODOR ENVELOPMENT.

(Praktische Erfahrungen bei der Kontrolle von
Oelfeuerungen zur Verminderung des
Russauswurfs und der Geruchsentwicklung). Text
in German. Staub, Reinhaltung Luft, 30 (8):328-
333, Aug. 1970. 23 refs.
Fritz Baum, and Werner Brocke.
Identifiers: *Odors, *Soot, *Oil burners, Germany, Fuel oils, Industrial emission sources, Measurement methods, Odorimetry, Samplers, Filters, Odor counteraction, Firing methods.

A successful annual testing of more than 300,000 oil-firing plants in North Rhine-Westphalia requires the use of the filter paper method for a reliable detection of particle emissions (soot), and of the pyridine test for detecting odorous components (oil derivatives). A series of special investigations has clarified the relationship between the test gas volume and soot number, between soot concentrations and soot number, and also between the emission of oil derivatives and nuisance caused by odor. Reliably regulated atomizing burners of good construction used for EL fuel oil ensure soot concentrations well below 10 mg/N cu m and odorless waste gases.
APTIC-23885

### CHARGING OF FIBER FILTERS WITH AEROSOLS OF LIQUID PARTICLES.

(Beladung von Faserfiltern mit Aerosolen aus
fluessigen Partikeln). Text in German. Staub,
Reinhaltung Luft, 30 (8):317,321, Aug. 1970. 8 refs.
Hasso Mohrmann.
Identifiers: *Droplets, *Filter fabrics, *Mathematical modeling, Germany, Aerosols, Particle size, Filters, Flow rates.

When fiber filters are charged with suspended matter consisting of liquid particles, there is a typical increase in the amount of material passing through. This has been determined experimentally for two different filter materials by using monodispersed aerosols of different particle sizes, and a polydispersed aerosol. Two mathematical models are discussed which correctly express the relationship between the initial amount of material passing through and accumulation capacity, and the particle size. A brief description is given of the measuring arrangement used, the most essential component of this arrangement being a sensitive instrument for continuous recording of aerosol concentration.
APTIC-23888

### INS AND OUTS OF GAS FILTER BAGS.

Chem. Eng., 77 (23):162, 164, 166, 167, Oct. 19,
1970.
John C. Walling.
Identifiers: *Bag filters, *Filter fabrics, Teflon, Synthetic rubber, Nylon, Glass fabrics, Treated fabrics, Maintenance, Design criteria, Crystal structure, Temperature, Tensile strength.

A guide to selecting the synthetic-fiber bag cloth and the bag cleaning technique that could most effectively and economically handle a particular problem is presented. Various glass and synthetic fabrics are discussed in terms of their resistance to temperature, abrasion, acids, and alkalies. The crystal structure of a fiber is what determines its tensile strength. Synthetic fibers include acrylics, nylons, fluorocarbons, (Teflon), polypropylene, and polyesters. Since almost all filter cloths are 99+% efficient, the greatest variety in design is found in the technique by which the filter bags are cleaned. Popular cleaning techniques include backwash, shaking, ejecting, and the newer improved ejecting. The problems of maintenance and access are discussed from a design perspective.
APTIC-23889

### THE USE OF INDUSTRIAL DUST EXTRACTORS.

(Einsatz von Industriestaubsaugern). Text in
German. Keram. Z., 22 (8):489-490, Aug. 1970.
U. Eicke.
Identifiers: *Dusts, *Filters, *Scrubbers, Costs, Germany, Silicosis.

Increasing wage costs make any manual works cleaning more and more uneconomical. For hygienic reasons, and in view of the danger of silicosis, more effective methods are required for the removal of dust. New types of apparatus are

described for the removal of dust from machines, equipment, shelves, and work clothing. For floor cleaning, there are vacuum cleaners, and for wet cleaning, machines for scrubbing and wiping dry. The economic aspect of this equipment is indicated by a calculation of plant costs according to the VDMA guide lines. (Author abstract modified)
APTIC-23896

### WET DUST EXTRACTORS- A REVIEW OF CURRENT TECHNOLOGY.

(Nabarbeitende Entstauber- Ein Ueber blick ueber den derzeitigen Stand der Technik). Text in German. Keram. Z., 22 (8):465-469, Aug. 1970. 5 refs.
H. Engels.
Identifiers: *Dusts, *Scrubbers, Germany, Design criteria, Pressure.

Wet dust extractors are used in many forms in almost all branches of industry. Provided that their design and construction are appropriate for the relevant plant conditions, they usually represent a good technical and economic solution to the dust problem. Diagrammatic illustrations are used to outline the present day position in this branch of dust extraction technology. Results from selected test studies show the effectiveness of the wet dust extractor in various pressure ranges, and a functional relationship is deduced between power expenditure and separation capacity. The frequency with which wet dust extractors are employed in various branches of industry is indicated. (Author abstract)
APTIC-23897

### WOVEN DUST EXTRACTORS FOR LARGE AIR FLOWS IN THE CERAMIC INDUSTRY.

(Gewebeentstaubung fuer grobe Luftstroeme in der keramischen Industrie). Text in German. Keram. Z., 22 (8):486-488, Aug. 1970.
H. Beck.
Identifiers: *Ceramics, *Dusts, *Filter fabrics, Germany, Design criteria, Flow rates, Temperature, Silicosis.

For large air flows, the question of whether recirculation of the air is possible or required always arises. The influence of the Z number, as a measure of the danger of silicosis, is explained, and an indication of the power required for air recirculation and the insertion of a filter stage after the woven dust extractor is given. The principles and construction of various woven dust extractors for normal working temperatures are described, as well as an apparatus for cleaning hot gases at continuous operating temperatures up to 300 C. (Author abstract)
APTIC-23898

### ODOR CONTROL IN KRAFT PULP MILLS.

Chem 26, 6 (9):30-34, Sept. 1970.
John P. Morgan.
Identifiers: *Kraft pulping, *Black liquor oxidation, *Odor counteraction, Canada, Odors, Scrubbers, Hydrogen sulfide.

Bivalent sulfur compounds in various gaseous effluents are the main source of odor from Kraft pulp mills. Systems for reducing odors from digester and multiple evaporator areas, from black liquor oxidation, and from contaminated condensate are detailed. The system for the non-condensables from the digester and evaporator areas is based on a special burning system operated on the simple principle of an inverted chamber inside a contaminant tank partially filled with water to provide a gas seal. Gases from the evaporators are scrubbed with a recycled caustic. A strong black liquor oxidation system prevents hydrogen sulfide stripping and reduces lime reburning requirements. Treatment of the contaminated condensate is effectly handled by air stripping alone or in combination with thermal oxidation processes.
APTIC-23901

### ELECTRICAL CONTROL METHOD AND APPARATUS.

(Assignee not given.) U. S. Pat. 3,527,022. 8p., 1970. 13 refs. (Appl. June 18, 1969, 15 claims).
William E. Archer, and Everett L. Coe Jr.
Identifiers: *Electrostatic precipitators, *Design criteria, *Voltage, Dusts.

At any given time during the operation of an electrostatic precipitator, there is a maximum value of the average discharge electrode voltage to obtain the maximum possible efficiency of dust collection under the conditions existing at that time. A system for controlling the average discharge electrode voltage of an electrostatic precipitator is described. The method involves generating a control signal in response to a decreasing average discharge electrode voltage, and alternately increasing and decreasing the power input to the discharge electrodes in response to successive control signals to cause the average voltage to be increased repeatedly through its peak value.
APTIC-23903

### APPARATUS FOR THE REMOVAL OF SULFUR OXIDES FROM WASTE GASES.

(Hitachi, Ltd., Tokyo, Japan) U. S. Pat. 3,504,483. 6p., April 7, 1970. 6 refs. (Appl. Sept. 8, 1967, 10 claims).
Zensuke Tamura, and Yukio Hishinuma.
Identifiers: *Carbon black, *Packed towers, *Adsorption (general), Japan, Stack gases, Carbon dioxide, Water.

An adsorption column for the removal of sulfur dioxide from stack gases is described. The device has a cylindrical body which is divided into several equal-sized chambers for adsorption by activated carbon and desorption of the carbon with carbon dioxide gas or water. Shifting rotating gas-passage sequentially changes the passage of gases in the chambers in such a manner that the desulfurization treatment is operated continuously. Previous methods utilizing activated carbon, because of the necessity of continuously regenerating and recirculating the adsorbent, had to have expensive and awkward power-driven mechanisms attached. The method described regenerates the adsorbent in place, thus saving significant amounts of money and time.
APTIC-23905

### AIR FILTERING SYSTEM.

(Assignee not given.) U. S. Pat. 3,504,481. 3p., April 7, 1970. 13 refs. (Appl. Dec. 11, 1967, 4 claims).
Agop G. Zakarian, and Nishan Balikjian.
Identifiers: *Electrostatic precipitators, *Filters, *Spray towers, Stack gases, Soot, Suspended particulates, Air conditioning equipment, Settling chambers, Sodium carbonate, Carbon dioxide, Sulfur oxides, Water, Pressure.

An air filtering system which utilizes both mechanical and chemical means is described. The polluted air is passed through an elongated path where electrostatic or electromagnetic forces collect carbon-like particles and deposit them into a depository. The air is then passed through a cold water forced spray and into a cooled solution of sodium carbonate to remove grease or soot. The air is then passed through a cooled creosote-based solution for removal of the carbon and sulfur content. Finally, the air is passed into a chamber and compressed to approximately 5-7 atmospheres and then excited into a pressurized enclosure three-fourths filled with water where any residual pollutants remaining are removed. The resulting air is pure enough to breath again.
APTIC-23906

### QUALITY OF COAL-TAR ABSORBENT OIL.

(O kachestve kamennougol'nogo poglotitel'nogo masla). Text in Russian. Koks i Khim., no. 6: 47-51, 1970.
P. F. Gurtovnik, D. P. Dubrovskaya, and Ye. A. Forer.
Identifiers: *Coal tars, *Absorption, *Benzenes, Ussr, Coke, Fuel gases, Chromatography, Naphthalenes.

A number of coal-tar absorption oils, used for the absorption of benzenes, have been analyzed chromatographically. The naphthalene content as determined by standard procedures is more than 1.5 times lower than the value obtained by chromatography. By fractional distillation of these absorption oils, it is possible to increase naphthalene yield from coal tar by 12% (relative), leaving an absorption oil of improved quality and stability in amounts up to 45% of the starting quantity. Laboratory results have been varified in a pilot study.
APTIC-23910

### INVESTIGATION OF TRAY-SPRAYER REGENERATORS FOR REMOVAL OF HYDROGEN SULFIDE FROM COKE OVEN GAS.

(Issledovaniye tarel'chatoforsunochnykh regeneratorov tesekha ochistki koksovogo gaza ot serovodoroda). Text in Russian. Koks i Khim., no. 6:31-35, 1970. 11 refs.
I. M. Khanin, V. A. Mizin, V. S. Kovalenko, A. T. Movchan, and O. G. Nelipa.
Identifiers: *Coke-oven gas, *Bubble towers, *Hydrogen sulfide, Ussr, Combustion gases, Coke, Fuel gases, Absorption, Design criteria, Mathematical analyses.

Experimental studies and prolonged-operation tests of tray regenerators of saturated soda- potash solution point up a need for further improvement of desorption equipment for vacuum-carbonate sulfur removal. A new type of industrial regenerator comprising a combination of hollow- and bubble-tower configurations is proposed. This design yields a power advantage at the same time that it improves the degree of regeneration. A sprayer disperses the saturated solution into a space above the bubble column, thus intensifying the desorption of hydrogen sulfide and significantly reducing steam consumption. Empirical formulae are given for determining the degree of regeneration and optimum process parameter when designing combination regenerators of this type.
APTIC-23911

### PROCESS FOR RECOVERING CONDENSIBLE COMPONENTS FROM A GAS STREAM.

(Black, Sivalls and Bryson, Inc., Kansas City, Mo.) U. S. Pat. 3,527,024. 8p., Sept. 8, 1970. 5 refs. (Appl. Nov. 5, 1968, 6 claims).
Robert E. McMinn, James A. Loomer, and Arnol I. Sellars.
Identifiers: *Vapor recovery systems, *Adsorption, *Design criteria, By-product recovery, Condensation, Cooling.

Existing stationary bed adsorption processes utilizing open or closed regeneration systems do not permit a high percentage of condensible components to be recovered from the gas stream. This is due primarily to the fact that the cooling gas stream is not sufficiently void of the condensible compounds to cause a sufficient equilibrium shift in the bed being regenerated. Thus, even though heating the bed with a hot regeneration gas will strip out and vaporize a sufficient quantity of condensible compounds, a redeposit or readsorption of the compounds will occur. To increase the recovery of the compounds, a special main gas flow pattern is provided at the beginning of each cycle and a series of stationary adsorption beds are utilized. A first bed adsorbs condensible compounds, a second bed is simultaneously cooled, and a third bed is simultaneously heated and stripped. During the first part of each cycle, the gas stream is serially passed through the second bed so that condensible compounds in the bed are swept out and through the first bed, where they are adsorbed. The first and second beds are then switched so that, during the remainder of the cycle, the gas stream serially passes through the first

bed to adsorb the condensible components and through the second bed to cool it. The compounds are stripped from the third bed with a closed-circuit regeneration gas stream, then condensed and recovered.
APTIC-23918

### VORTEX RINGS FOR EFFLUENT REMOVAL.
For primary bibliographic entry see Field 14.
APTIC-23919

### THE ZINC-AIR BATTERY SYSTEM.
Edison Elec. Inst. Bull., 38 (7):228-231, July-Aug. 1970. 1 ref. (Presented at the Edison Electric Institute, 38th Annual Convention, Boston, Mass., June 2, 1970.)
Giovanni Caprioglio.
Identifiers: *Storage batteries, *Vehicles, Zinc, Electric propulsion, Buses, Trucks, Design criteria, Electrolysis.

The present joint program between Edison Electric Institute and Gulf General Atomic is directed toward the development of a zinc-air battery system as a power source for electric industrial trucks, delivery vans, city buses, and perhaps even commuter automobiles of the future. The zinc is stored in the battery by electrochemically plating the metal on thin support plates to form the zinc electrodes; oxygen is the reactant at the other electrode, made of porous nickel, and comes to the cell either from air or from pressurized storage. Zinc oxide, the product of the reaction, is swept away by the electrolyte and carried to a filter where it is stored. Storage of the reaction products outside of the cell eliminates the need for supporting structures and thus allows a lighter construction. It permits essentially complete utilization of the zinc during discharge and, in addition, prevents accumulation of reaction products on the plates which tend to impede the reaction in battery systems without circulation. Recharging and a battery prototype are also discussed.
APTIC-23920

### SUPER FLYWHEEL TO POWER ZERO-EMISSION CAR.
Pop. Sci., 197 (2):41-43, 98, Aug. 1970.
Alden P. Armagnac.
Identifiers: *Flywheel, *Vehicles, *Design criteria, Construction materials, Operating variables, Electric propulsion, Automobiles, Buses.

An engineer's scheme for revamping the 5000 year-old flywheel promises a new kind of stored power to drive autos, boats, lawn mowers, and power tools. Until now, flywheels have always been made of materials equally strong in all directions, but the essence of D. W. Rabenhorst's superflywheel concept is to use a material that is extra strong in one particular direction--the outward direction of the stress that seeks to pull a fast spinning flywheel apart. The flywheel could be made of radial filaments of high strength steel music wire, currently available with a tensile strength of 600,000 ponds to the square inch. However, the new composite materials on the way will be better yet. They consist of high strength graphite or boron fibers, or of pure and strong crystals called 'whiskers' embedded in a matrix of plastic or metal. To charge the midget car with energy, the super flywheel has an electric motor, which you simply plug into an outside power source to bring the rotor up to speed. Then the motor becomes a generator, driven by the whirling flywheel, to supply current to individual electric driving motors on the car's wheels. A 70-passenger Swiss bus which uses a flywheel is described, as well as further advantages concerning its use.
APTIC-23921

### FASTENING MEANS FOR ELECTRICAL DISCHARGE WIRES.
(Kloeckner-Humboldt-Deutz A. G., Cologne (West Germany) U. S. Pat. 3,527,025. 3p., Sept. 8, 1970. 10 refs. (Appl. July 9, 1968, 2 claims).
Hubert Josef Kinne.
Identifiers: *Metal fabricating and finishing, *Electrostatic precipitators, *Design criteria, Germany.

Individual electrical discharge wires in electrostatic dust separators are customarily suspended from a supporting beam by their upper ends; a counterweight is attached to their lower ends. The fastening of the wires to the beam presents difficulties because they must extend above the beam and be arranged so that damaged wires can easily be replaced. Due to the strain on the wires caused by knocking operations, it is impossible to weld them directly to the beam. The problems are solved by securing each wire to a sheet metal sleeve by a crimping (solderless) or welding operation, the sleeve extending in turn through aligned holes in a hollow supporting beam to which it is welded. An advantage is that for wires of different core diameters, a uniform sleeve can be employed, which permits the use of uniform bores for the reception of the sleeve in the supporting beam. In addition, the sleeve can be connected to the wire outside the housing and then pushed through a bore for subsequent welding. This simplifies replacement of damaged wires and also permits part of the wire to project a sufficient distance above the beam.
APTIC-23922

### EUROPE STUDYING LEAD-FREE GASOLINE.
Automotive Ind., 143 (3):33-35, Aug. 1, 1970.
Personal Author Not Recorded.
Identifiers: *Fuel additives, *Lead compounds, *Gasolines, Gas turbines, Diesel engines, Automotive emission control, Carburetion.

Elimination of lead from gasoline results in the reduction of octane values, which in turn means that lower engine compression ratios are mandatory. While this will not have too much effect on large American engines, in Europe the small high-efficiency engine relies on high compression for that efficiency. Sweden is introducing regulations to reduce the lead content of gas progressively until fuel is lead-free by 1980. Volvo was the first European manufacturer to fit emission-control as standard on all its cars in 1968. A large proportion of these Volvo cars are fitted with the Strombery Constant Depression Starter Emission (CDSE) carburetors as supplied by Zenith in England. Zenith has been in the forefront in Europe in exhaust control, and its laboratories at Dunstable were among the first to be certified by the California authorities. The diesel, gas turbine, and Wankel engines are mentioned.
APTIC-23923

### COMPRESSED NATURAL GAS: ANOTHER CLEAN-AIR FUEL.
Pop. Sci., 197 (2): 30, Aug. 1970.
Joseph Zmuda.
Identifiers: *Natural gas, *Trucks, *Compressed gases, Operating variables, Transportation, Automotive emission control, Air-fuel ratio, Carburetion, Maintenance, Methanes.

Recently, the Pacific Lighting Corporation started converting its trucks to run on compressed natural gas. The simple conversion system that they evolved not only reduces exhaust emission by as much as 90%, it also prolongs engine life by keeping the engine clean. Spark plugs and lubrication oil last longer, too, thus cutting maintenance costs. Natural gas consists primarily of methane, a low-molecular weight hydrocarbon with an octane rating of 130 and clean-burning properties. The natural gas is compressed to 2200 psi in steel tanks. Two stages of regulation reduce fuel pressure to 0.07 psi before the gas is admitted to a special mixer/air filter that replaces the air cleaner atop the old carburetor. A choke like device alters the air/fuel ratio when the vehicle runs on gasoline. Solenoid valves control fuel choice.
APTIC-23924

### WISHART'S POLLUTION-REDUCIN' SPLIT-CYCLE ENGINE.
Nat. Eng., 74 (7): 6-7, July 1970.
Personal Author Not Recorded.
Identifiers: *Wishart engine, *Design criteria, Gasolines, Operating variables, Power sources, Engine design modification.

The Wishart engine, named for its Australian inventor, runs on a split cycle principle, so-called because two different parts of the engine are used to separately perform the 'cold' and 'hot' functions of the working cycle. Compression, to double the ratios now in common use, is performed exclusively in cold cylinders, and air charge is then piped to the power cylinders. External temperature control of the air charge enables lead-free gasoline, also fuels such as kerosene, to be used without detonation. Combustion is performed in chambers with walls much hotter than those in conventional engines. Weaker mixtures are burned more effectively and cleanly, with production of very few undesirable residues. High power output for small size and light weight is claimed for this split-cycle engine. Power cylinders, air compressors, the heat exchanger, crankshaft, camshaft, radiator, and specifications are mentioned. (Author abstract)
APTIC-23925

### ASPHALT PLANT ELIMINATES PLUMES.
Mod. Power Eng., 64 (6):84-85, June 1970.
Personal Author Not Recorded.
Identifiers: *Asphalt, *Mineral processing, *Bag filters, *Dusts, Stack gases, Operating variables, Automatic methods, Filter fabrics, Secondary air, Design criteria, Safety equipment, Temperature.

A dry fabric dust collector was used by an asphalt plant to control the dust laden gases at temperatures in excess of 300 F which are generated from the rotating drum dryer. Called the Mikro Pulsair, this collector is completely automatic, self-contained, and has an automatically purged, self-unloading fabric collector. More than 500 eight foot long filter bags are supported by wire retainers and suspended from a single tube sheet located near the top of the housing. Dust collection is made on the outside of the filter bags, and bag cleaning is effected by short pulses of 100 psi compressed air fed via aluminum venturis down into the filter tubes. Secondary air is induced from the clean air plenum, further adding to the bag cleaning action. The fine dust cleaned from the filter bags falls into the bottom of the hopper, where it is discharged by means of a 9 inch screw conveyor, sealed against the atmosphere by an airlock. Nomex felted filter bags capable of withstanding 425 F are used. A high temperature alarm and safety device mounted in the duct system are designed to protect the fabric, should the temperature rise agove the working limits, by introducing cold outside air.
APTIC-23927

### NEW PROCESS REMOVES STACK-GAS SULFUR.
Oil Gas J., 68 (28):49-50, July 13, 1970.
Personal Author Not Recorded.
Identifiers: *Petroleum refining, *Absorption (general), *Peter spence process (claus), Costs, Stack gases, Chemical processing, Pilot plants, Scrubbers, By-product recovery, Design criteria, Sulfur compounds, Hydrogen sulfide, Temperature.

Sulfur is recovered from refinery gases or tail gases of a Claus sulfur plant containing low concentrations of sulfur dioxide and large volumes of hydrogen sulfide. Results obtained from a 66-lb/day pilot plant at Solaise, France, showed that the new route can replace the amine-sweetening and Claus plants conventionally used to recover sulfur from these refinery gases. Tail gases containing H2S and SO2 are fed into a packed absorber column, and the Claus reaction occurs in a solvent in the presence of a catalyst. Since the reaction takes places at a temperature of 130 C,

sulfur is produced in liquid form and is taken off in the molten state directly from the bottom of the column. Solvent withdrawn from the column from above the liquid sulfur is recycled to the top of the absorber following the addition of makeup solvent and catalyst. The treated gas is vented from the top of the column to a stack. Holding the tail gas at the 130 C exit temperature from the Claus unit keeps the sulfur in liquid form and prevents plugging of the lines. Low reaction temperature also inhibits the formation of colloidal sulfur formed during water condensation and insures that there will be no expense involved in heating the reactants to operating temperatures. Battery-limit investment for a plant able to treat 600,000 cfh of 0.6 vol % acid gas is given as $230,000, not including royalty charges.
APTIC-23928

### ESTIMATING EXHAUST-AIR REQUIREMENTS FOR PROCESSES.

Chem. Eng., 77 (17):116-118, Aug. 10, 1970.
John D. Constance.
Identifiers: *Chemical processing, *Design criteria, *Exhaust systems, Flow rates.

In many chemical process applications, the correct airflow for inplant contamination control can be calculated by using the proper exhaust criteria. The air quantities required for local exhaust systems are based on a number of design factors, especially capture velocities. Most applications in the chemical process industries will require capture velocities ranging from 50 to 200 fpm at a point in the system where the contaminant will tend to escape into the room. The lower value is used to control contaminants released at low speed in relatively quiet air, while the higher values are used to control contaminants released at high rates or released to an atmosphere fraught with disturbing crosscurrents. Other factors that affect air exhaust flows are the area of the openings and the capture distance. To keep a building from operating under negative pressure, every cubic foot of air that is exhausted from a building must be replaced. Data providing specific exhaust criteria are presented tabularly to check an existing plant operating or to design for an adequate makeup air system. Several typical plant problems are included.
APTIC-23932

### HYDRODESULFURIZATION.

Catal. Rev., 4 (2):245-318, 1970. 191 refs.
S. C. Schuman, and H. Shalit.
Identifiers: *Hydrodesulfurization, Costs, Fuel oils, Distillate oils, Residual oils, Operating variables, Hydrogen, Hydrogen sulfide, Catalysts, Catalytic activity, Liquids, Vapors, Reaction kinetics, Reaction mechanisms.

The desulfurization of petroleum and petroleum fractions is almost universally accomplished by the catalytic reaction of hydrogen with sulfur compounds in the charge stock to produce hydrogen sulfide, which is readily separable from the oil. The technology of hydrodesulfurization is well established. The overall weight equivalent cost is possibly the lowest of any chemical transformation being practiced industrially. This is astonishing, since the co-reactant hydrogen is a costly chemical, and since the reaction is effected at relatively high temperatures and pressures over a catalyst whose function is little understood. Although this review discusses both vapor-phase and liquid phase hydrodesulfurization, and the hydrodesulfurization of both petroleum distillates and residuums, the emphasis is on the liquid-phase hydrodesulfurization of residuums, because of both its urgent economic necessity and its complex chemical, catalytic, and engineering aspects. The fundamentals of desulfurization are reviewed, and the chemical and catalytic mechanisms are discussed. Reaction kinetics, reactor engineering, and operating variables are described. The commercial applications of the hydrodesulfurization of whole crude oils and residuums are presented.
APTIC-23937

### SMELTING CONCENTRATES IN CONVERTERS AND PRODUCTION OF SULFUR DIOXIDE FOR SULFURIC ACID MANUFACTURE.

Soviet J. Non-Ferrous Metals (English translation from Russian of: Tsvetn. Metal.), vol. 9 (10):39-42, Oct. 1968.
V. D. Nagibin.
Identifiers: *Blast furnaces, *Chemical processing, *So2 removal (combustion products), *Sulfuric acid, Copper, Ussr, Combustion gases, Primary metallurgical processing, Electrostatic precipitators, By-product recovery, Combustion air.

Industrial tests were performed on the converter smelting of copper matte in an air blast enriched with up to 24-27% oxygen. The output capacity of converters increased proportionally to the percentage of oxygen in a blast. The temperature of the molten charge in converters increased sharply as a result of the heat of exothermic reactions; this permitted the processing of cold additions in the form of ore, concentrate, and other copper-containing materials. Concentrations of sulfur dioxide in the waste gases of the converter increased by 1.5-2.5% (in absolute value), varying during the second blowing period by 5-10%. The operating regime of the converters decreased markedly when enriched blasts were used during the first and second blowing stages. On the basis of these findings, programs were developed for the smelting of pelletized copper concentrates and for the production of sulfuric acid from converter waste gases alone. The latter process is based on a starting concentration of about 4% SO2 in converter waste gases fed to a contact-reaction vessel and on special conditions for matte blowing. At least two converters are continually on blast, the blast consumption of each varying between 30,000 to 45,000 cu m/hr. Before being passed to the sulfuric acid production plant, the exhaust gases are pressure fed by a blower to electrostatic dust separators. An automatic switching system for changing the direction of the gases from the sulfuric acid units to stack exhaust makes it possible to stabilize the content of sulfur dioxide being shipped to the former.
APTIC-23939

### FABRIC FILTERS.

Can. Mining J., 91 (10):72-80, Oct. 1970.
G. A. Dick.
Identifiers: *Bag filters, *Filter fabrics, *Design criteria, Canada, Particulates, Permeability, Surface properties, Temperature, Tensile strength.

A baghouse is one of the most effective methods of controlling air pollution; fabric filters demonstrate exceptionally high collection efficiencies for airborne particulates. These filters are discussed at length within the context of four basic design parameters: type of fabric, fabric form, cleaning method, and housing. Comparative properties of many popular fibers are listed in an appendix. Applications are noted for natural woven and felted cloth fabrics and for man-made fibers, in both filament and spun form. Also considered are fabric permeability, tensile strength, abrasion resistance, collection efficiency, dimensional stability, and the influence of static electricity on filtration. Fabric variables considered are thread count, yarn size, napping, yarn twist, changes in weave or organization, and staple vs. multi-filament yarns. The major forms of filter bags examined are the flat (envelope) bag and the round (tubular) bag. Cleaning methods reviewed are shaking and reverse flow, alone or in combination. With respect to housing, the trend to modular design and factory assembly of metal housing is noted. The state of the art of dry filtration is expected to improve as the result of better cleaning methods and higher filter ratios. Also anticipated are fabrics able to operate in the 700-1000 F range.
APTIC-23940

### GAS FILTER APPARATUS.

(American Air Filter Co., Inc., Louisville, Ky.) U. S. Pat. 3,520,111. 3p., July 14, 1970. 11 refs. (Appl. Nov. 5, 1968, 2 claims).
Alan E. Revell, and Wilson A. Welch.
Identifiers: *Electrostatic precipitators, *Design criteria, Gases.

In the past, various devices have been used to mount plate electrodes in the housing of electrostatic gas filters. These devices have been complex, difficult to maintain, and subject to problems of plate alignment. In addition, gas leaks occur when the plate electrode assemblies are in side-by-side relationship in the flow-through housing. The electrostatic gas filter described overcomes these disadvantages by providing each plate electrode with longitudinally extending skids that horizontally transverse the upstream and downstream sections of the gas stream. These skids engage track members in the flow-through housing to provide support of the plate electrodes during gas treating operations. Each plate electrode has a flexible seal member that extends in cantilever fashion to overlap the side of the adjacent electrode, arranged in a side-by-side relationship. Having a minimum of moving parts and hardware, the filter arrangement eliminates the expensive bearing and wheel assemblies of the past. At the same time, it permits rapid insertion and removal of plate electrodes with a minimum of injury to plate assemblies and a minimum of gas leakage.
APTIC-23941

### STUDY OF CONTINUOUS FLOW COMBUSTION SYSTEMS FOR EXTERNAL COMBUSTION VEHICLE POWERPLANTS.

Marquardt Corp., Van Nuys, Calif., NAPCA Contract CPA 22-69-128, 159p., June 1970. 22 refs. CFSTI: PB 193417
C. V. Burkland, W. B. Lee, G. Bahn, and R. Carlson.
Identifiers: *External combustion, *Automotive emission control, *Reaction kinetics, *Combustion, Emission standards, Continuous, Engine exhausts, Particulates, Operating variables, Power sources, Vehicles, Automobiles, Air-fuel ratio, Combustion air, Secondary air, Design criteria, Hexanes, Methanes, Flow rates, Gases.

Chemical kinetics were employed to better understand how and at what rate air pollutants are formed in an external combustion process. An experimental combustion test rig employing a recirculating step, staged burner was built. Tests were conducted with various liquid and vaporized liquid fuel injectors using aviation turbine fuel (jet A) and 2,2,5-trimethylhexane. A wide range of fuel-air ratios was examined by individually controlling primary and secondary air flow rates. Fuel flows were varied from a maximum corresponding to a heat release of 500,000 BTU/hr to 1/30 of this value. Two runs were made using gaseous methane fuel. Injector configurations included pressure atomizing, vaporizing, and vaporizing premixed. Fuel flow was varied from 0.15 to 4.5 gal/hr and air flow from 3.4 to 103 scfm. In all, 140 test conditions were investigated. Gaseous and particulate emissions less than those established as the 1980 Federal Research goals can be achieved simultaneously in a high heat release, low pressure drop burner configuration. The emission data measured at steady state conditions is compared to current and future emission goals for automobiles.
APTIC-23945

### CONCEPTUAL DESIGN. RANKINE-CYCLE POWER SYSTEM WITH ORGANIC WORKING FLUID AND RECIPROCATING ENGINE FOR PASSENGER VEHICLES.

Thermo Electron Corp., Waltham, Mass., Research and Development Center, Contract CPA 22-69-132, Rept. TE4121-133-70, 233p., June 1970. 14 refs. CFSTI: PB 193418
Dean T. Morgan, and Robert J. Raymond.
Identifiers: *Operating criteria, *Rankine cycle power system, *Design criteria, Costs, Automotive emissions, Engine exhausts, Particulates, Power sources, Internal combustion engines, Automotive emission control, Hydrocarbons, Carbon monoxide, Nitric oxide (no), Temperature.

The system which, comparatively offers the greatest potential for absolute minimum emission of particulates, unburned hydrocarbons, nitric oxide, and carbon monoxide in a system with range and power equivalent to the internal combustion engine is the Rankine-cycle system. A conceptual design is prepared of a Rankine-cycle power system with organic working fluid and reciprocating engine for a low-emission automotive propulsion powerplant. The goal of the study is development of a system competitive in cost, performance, and driver convenience with the internal combustion engine system using current technology wherever possible. The component designs and characteristics are presented. The complete 100 net shaft horsepower system is packaged in the engine compartment of a 1969 Ford Fairlane; the predicted performance characteristics are presented. The system is closely competitive, in 0 - 60 mph acceleration time and in level-grade top speed, with a 302 cubic inch displacement internal combustion engine with three-speed transmission. The fuel economy in customer-average mpg is approximately 20% less than the 302 cubic inch internal combustion engine. The use of thiophene as a working fluid, with a moderate maximum cycle temperature of 550 F, permits a significant cost reduction relative to the equivalent steam system. This reduction may permit the Rankine-cycle system to be competitive costwise with the equivalent internal combustion system, particularly since the stricter emission level standards will require significant cost increases in the future in the internal combustion system. Projection of current burner data indicates a strong potential for emission levels significantly less than the projected 1980 federal standards for all three of the major pollutants: unburned hydrocarbons, carbon monoxide, and nitric oxide. (Author abstract modified)
APTIC-23946

### BASIC STUDIES IN GAS-SOLID SUSPENSION. (FINAL REPORT.).

For primary bibliographic entry see Field 06.
APTIC-23953

### A POLLUTION-FREE HYBRID FOSSIL-NUCLEAR FUELED MHD POWER CYCLE.

Brookhaven National Lab., Upton, N. Y., 48p.,
March 1968. 13 refs. NTIS: BNL-12319
M. Steinberg, J. R. Powell, M. Beller, and B.
Manowitz.
Identifiers: *Magnetohydrodynamics (mhd), Costs, Coal, Nuclear power plants, Steam plants, Nuclear power sources, Design criteria.

A hybrid power plant is developed based on a hydrogen-oxygen combustion MHD cycle. Hydrogen is generated by reforming fossil fuel with nuclear generated steam, and oxygen is obtained from air in an air separation plant. Steam is injected into the combustion gases to control temperature and pressure through the duct. A preliminary parametric study of the cycle efficiency and MHD characteristics is made with steam and helium as diluent. Overall thermal efficiencies of 55% appear practical with nuclear energy contributing 38% and coal 62% to the power cycle. Preliminary design capital investment, production cost, and breakeven fuel cost estimates are presented. The hybrid system offers a number of technical and economic advantages. It allows the use of fossil fuel in a pollution-free plant; conventional water and gas-cooled nuclear reactors can be utilized in an MHD cycle; thermal pollution is significantly decreased; a clean MHD duct is provided. The preliminary evaluation indicates that the system allows fossil fuel to compete with nuclear energy in high fossil fuel cost areas and conversely, it allows nuclear energy to compete in low fossil fuel cost areas, thus expanding the market for both fuel sources. Further detailed investigation of the system is recommended. (Author abstract)
APTIC-23954

### REMOVAL OF SUB-MICRON PARTICLES FROM INDUSTRIAL GASES, PARTICULARLY IN THE STEEL AND ELECTRICITY INDUSTRIES.

Intern. J. Air Water Pollution (London), vol. 6:229-263, 1962. 57 refs.
G. Underwood.
Identifiers: *Dusts, *Electrostatic precipitators, *Bag filters, *Venturi scrubbers, Costs, Steel, Great britain, Fumes, Electric power production, Primary metallurgical processing, Operating variables, Particle size, Filter fabrics, Design criteria, Voltage.

The basic theory of electro-precipitators, fiber and bag filters, and venturi scrubbers is described, together with modern equipment capable of dealing with submicron dust particles. Difficulties involved in continuous operation at efficiencies over 99% are discussed with particular reference to the steel industry and power stations. However, the information presented should be applicable to small particles in general, and to any industry producing this fine dust. General conclusions drawn are that electro-precipitators are very suitable for collecting dust or fume with a resistivity between 10,000 ohm cm and 2 times 10 to the 10th power ohm cm. To ensure good operation, perforated distribution plates and turning vanes must be used to keep an even flow of dust and gas. Voltage should be maintained at its highest level by means of flat collecting electrodes with stiffeners at the edges of each sheet. Bag filters, especially those cleaned by a blow-ring and reverse jet can handle much higher dust loadings than electro-precipitators. Wool felt bags can handle gas up to 90 C; while silicone-treated glass bags, up to 300 C. The pressure drop of a bag filter can vary from 2 in. wg when clean to 6-8 in. wg when dirty; the pressure drop through an electro-precipitator rarely rises above 0.5 in. wg. The venturi scrubber is able to remove dust or fume of any size with efficiencies of over 99%, but pressure drops can increase to 30 in. wg. In general, venturi scrubbers have lower capital costs but higher running costs than electro-precipitators and bag filters.
APTIC-23955

### STUDY OF UNCONVENTIONAL THERMAL, MECHANICAL, AND NUCLEAR LOW-POLLUTION-POTENTIAL POWER SOURCES FOR URBAN VEHICLES.

Battelle Memorial Inst., Columbus, Ohio,
Contract PH 86-67-109, Rept. APTD 69-51, 160p.,
Oct. 1969. 113 refs. CFSTI: PB 192321
J. A. Hoess, E. S. Cheaney, F. A. Creswick, D. A.
Trayser, and R. D. Fischer.
Identifiers: *Power sources, *Automobiles, Research programs, Costs, Urban areas, Automotive emissions, Fuels, Magnetohydrodynamics (mhd), Thermal radiation.

Background information and recommendations are provided for development of future research and development programs on low-pollution-potential propulsion systems for urban vehicles. Alternative systems were evaluated on the basis of the characteristics that they could be expected to have 10 to 15 years in the future, assuming that development efforts were expended on them. Twelve specific chemical fuels were selected as the most likely candidates for urban vehicle application and were studied to determine their physical and cost characteristics. A general description, historical development, current experimental automotive units, emissions, and physical, performance, and cost characteristics are discussed for several external combustion engines. These include the Brayton cycle (gas turbine) engines, Rankine cycle (steam) engines, and Stirling cycle (hot air) engines. Direct thermal-to-electric energy converters include magnetohydrodynamic power generation, thermoelectric power generation, thermionic conversion of heat to electricity, and thermophotovoltaic generation of electrical power. Other energy storage and conversion devices include thermal energy storage, mechanical energy storage, vehicle transmissions, and nuclear devices. Three principal means of mechanical energy storage are considered: the storage of kinetic energy in flywheels, the elastic deformation of solids (springs), and the compression of a gas, namely in terms of a hydraulic accumulator system. Vehicle transmissions are divided into mechanical, hydrokinetic, hydrostatic, and electric. With respect to nuclear devices, the two major sources of nuclear energy, fission reactors and radioisotopes, and two direct nuclear-to-electric energy conversion devices, alpha- and betavoltaic cells, were studied to determine whether they would be applicable for use in urban vehicles.
APTIC-23958

### SULFUR RECOVERY FROM FLUE GAS VIA REVERSIBLE DRY ABSORBENT. (SUMMARY REPORT).

Callery Chemical Co., Pa., NAPCA Contract PH
22-68-40, Rept. CCC 69-31, 76p., 1969. 2 refs.
CFSTI: PB 193483, 193531
M. D. Marshall, and B. B. Carr.
Identifiers: *Catalytic oxidation, *Absorption (general), Costs, Feasibility studies, Stack gases, By-product recovery, So2 removal (combustion products), Sulfuric acid, Sodium compounds, Vanadium compounds, Oxides, Sulfates, Reduction, Reaction kinetics, Temperature.

The process is presented which is based on the use of a dry absorbent which will catalyze the oxidation of sulfur dioxide to sulfur trioxide and absorb the SO3 from the gas stream. The catalyst-sorbent, which consists of sodium sulfate and vanadium pentoxide impregnated on a silica substrate, absorbs SO3 via the formation of sodium pyrosulfate in accordance with the equation Na2SO4 plus SO3 yields Na2S207. The catalyst-sorbent is regenerated by heating, and the sulfur oxides are recovered either in the form of concentrated sulfuric acid or as a concentrated stream of SO2 gas suitable for reduction to sulfur. The reaction is rapid and quantitatively reversible; the equilibrium pressure of SO3 increases sharply with temperature in a range well suited to a cyclic process for recovering sulfur oxides from flue gas. Estimated capital and operating costs show that the process is competitive with alternative processes now being considered. In areas where a market for concentrated sulfuric acid or oleum exists, the process would be especially attractive; it is believed that a profitable recovery situation could be developed. Potential advantages over alternative processes result from the use of a low cost fly ash sorbent and from the relatively low regeneration temperature, which minimizes corrosion problems. Further study is recommended to develop a sorbent, based on fly ash impregnated with V2O5 and Na2SO4, which is suitable both for oxidation of SO2 and for absorption of SO3, and will have physical properties suitable for large scale gas-solid contacting. (Author conclusions modified)
APTIC-23963

### GASEOUS WASTE DISPOSAL.

Ind. Gas, vol. 47:16-23, July 1968. (Presented at
the East Ohio Gas Co. seminar on waste disposal,
Cleveland, Ohio.)
L. C. Hardison.
Identifiers: *Combustion gases, *Afterburners, Costs, Odors, Solvents, Industrial emission sources, Chemical processing, Food and feed operations, Metal fabricating and finishing, Paint manufacturing, Catalytic afterburners, Flame afterburners, Scrubbers, Absorption, Temperature.

The three basic oxidation processes for incineration of waste gases are flame, thermal, and catalytic incineration. The three differ basically in the temperature to which the gas stream must be heated. Flame incinerators are most often used for closed chemical reactors; however, if the concentration of combustible contaminants in air air stream is well below the lower limit of flammability, direct thermal incineration is considerably more economical. Catalytic incineration is widely

used for the oxidation of paint solvents, odors from chemical and food operations, and for other functions that help offset the cost of air pollution control equipment; it operates below the limits of flammability and below the normal oxidation temperatures of the contaminants. The catalytic systems are the least costly when comparisons are made at the optimum level of heat recovery. Details of the three methods are given, particularly in terms of the operating costs of the equipment; several applications are briefly considered, including wire enameling, metal lithography, and kettle cooking. Carbon absorption and wet scrubbing are among the alternatives for some applications where incineration is not appropriate. The general steps in choosing a gas disposal system for a particular emission are outlined.
APTIC-23967

### THE RECOVERY OF SULPHUR FROM HYDROGEN SULPHIDE.

J. Soc. Chem. Ind., vol. 16:980-981, Dec. 31, 1897.
F. J. R. Carulla.
Identifiers: *Hydrogen sulfide, *Sulfur dioxide, *By-product recovery, Chemical processing, Kilns, Ammonium compounds, Sulfur compounds.

Recovery of sulfur from the hydrogen sulfide evolved in the manufacture of ammonia sulfate and in other chemical processes is increased 50% above that obtainable by the Claus method in a process based on the reaction 2H2S + SO2 equals 2H20 + 3S. The reaction can take place in an ordinary pyrite kiln to which hydrogen sulfide is properly admitted together with air highly impregnated with sulfur dioxide. A combustion chamber, into which the two gases are led through seperate passages, can also be employed. The amount of sulfur dioxide needed for the reaction can be obtained from the combustion of pyrite ores.
APTIC-23970

### RECOVERY OF SULFUR DIOXIDE FROM WASTE GASES BY MEANS OF CYCLICAL KETONES I.

(Ueber die Gewinnung von Schwefeldioxyd aus Abgasen mit Hilfe cyclischer Ketone. I.). Text in German. Chemiker Z., 53 (25):245-247, March 27, 1929. Part II. Ibid., 53 (26):266-267, April 10, 1929.
G. Weissenberger, and L. Piatti.
Identifiers: *Combustion gases, *By-product recovery, *So2 removal (combustion products), *Ketones, Germany, Contact processing, Absorption (general), Mercury compounds, Sulfur dioxide, Catalysts.

Sulfur dioxide present in waste gas from a sulfuric acid plant (contact process) in a quantity of 6-7 g per cu m was absorbed in laboratory experiments by clear technical cyclohexanone (boiling begin 150/152 C) and by clear technical methylcyclohexanone at 15 to 20 C in wash bottles and the absorbed SO2 was subsequently recovered by heating the solvents to 80 C. The absorbed SO2 was determined by titration with an iodine solution. The quantity of SO2 absorbed by the two solvents varied with temperature, at a practical operating temperature of 15-20 C approximately 0.25% by weight SO2 was absorbed. The addition of metallic mercury to the solvents had a marked positive or negative effect on the SO2 absorption capacity of both solvents depending on temperature. The percentage of SO2 in the waste gas affected positively the absorption capacity of the two solvents from 0 to 5% SO2.
APTIC-23972

### PROCESS FOR THE MANUFACTURE OF REDUCTION PRODUCTS FROM SULFUR DIOXIDE.

(Verfahren zur Darstellung von Reduktionsprodukten des Schwefeldioxyds). Text in German. (Chemische Fabrik Rhenania A. G. Aachen (West Germany)) Ger. Pat. 305,621. 2p., Nov. 20, 1922. (Appl July 18, 1917. 3 claims).
B. C. Stuer.
Identifiers: *Iron oxides, *Reduction, *By-product recovery, *So2 removal (combustion products), Germany, Combustion gases, Aluminum oxides, Chromium oxides, Silicates, Water.

A process is presented for manufacturing reduction products of sulfur dioxide by conducting sulfur dioxide and reducing gases over contact materials. The contact materials are iron oxides containing water of hydration, which can be prepared synthetically or can be from a natural source such as bog iron ore. The reaction may also take place in the presence of certain materials used as carriers, such as hydrated aluminum oxides, chromium oxides, or silicates which have the property of forming compounds with water at higher temperatures. An alternate procedure is to use anhydrous iron oxides instead of the hydrated oxides, these becoming hydrated during reduction, which takes place at more moderate temperatures.
APTIC-23973

### PROBLEMS INVOLVED IN DETERMINING MINIMUM STACK HEIGHT ON THE BASIS OF METEOROLOGICAL AND AIR QUALITY CONSIDERATIONS.

For primary bibliographic entry see Field 14.
APTIC-23974

### PROCESS FOR THE PRODUCTION OF SULPHUR FROM SULPHUR DIOXIDE.

(Consolidated Mining and Smelting Co. of Canada, Ltd., Montreal (Quebec) U. S. Pat. 2,080,360. 3p., May 11, 1937. (Appl. Jan. 13, 1936, 12 claims).
Robert Lepsoe.
Identifiers: *By-product recovery, *So2 removal (combustion products), *Reduction, Canada, Ashes, Combustion gases, Dusts, Coke, Mineral processing, Arsenic compounds, Sulfides, Catalysis, Catalysts.

A process is described to remove such impurities as dust, fine particles of carbon, and ash during the production of pure sulfur from sulfur dioxide which has been reduced by carbon; the method applies particularly to arsenic-bearing cokes or ores such as pyrites which may contain such impurities. The convertible sulfur formed by the SO2-carbon reaction is converted into carbon oxysulfide by introducing SO2 into the carbonaceous fuel bed. The gas is then cooled below the condensation point of sulfur and solid and condensed impurities are separated f[illegible] the carbon oxysulfide. More clean SO2-be[illegible] gas [illegible]dded to convert the carbon oxysulfid[illegible]r and carbon dioxide, from which substant[illegible] pure sulfur is condensed after being catalyzed [illegible]ccelerate the process.
APTIC-2397[illegible]

### RECOVERY OF AMMONIUM SULPHATE FROM SULPHUR DIOXIDE IN HOT FLUE GASES (VII). REMOVAL CARBON FROM THE CATALYST.

(Ryuan o fukusei suru Endohaigasu no jyogaiho (VII). z Syokubaiso ni hirai suru minenkabon no syoriho ni tsuite). (Source Not Given) p. 395, 1968 (*). Translated from Japanese. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 2p., Oct. 27, 1969.
Raisaku Kiyoura, Haruo Kuronuma, and Yoshisuke Uenishi.
Identifiers: *Catalytic activity, *By-product recovery, *Catalytic activity, Carbon black, Japan, Stack gases, Catalytic oxidation, So2 removal (combustion products), Ammonium compounds, Vanadium compounds, Sulfates.

In the Kiyoura-T.I.T. process for recovering ammonium sulfate from flue gases, sulfur dioxide is catalytically oxidized to sulfur trioxide with a vanadium oxide catalyst, after which ammonia is injected into the system. The possibility that carbon escaping from cyclones could deactivate the catalyst led to experiments in which carbon was placed on the catalyst (150-250 mesh) and its rate of oxidation studied at different partial pressures of oxygen. The reaction proceeded rapidly with oxygen at 2%. Moreover, the addition of carbon to the catalyst had no effect on the oxidation of SO2 at 400, 450, and 500 C, indicating that the catalyst was not deactivated.
APTIC-23976

### INFLUENCE OF FLOW VELOCITY, PARTICLE SIZE AND CONCENTRATION ON THE SEPARATION EFFICIENCY OF SUSPENDED PARTICLE FILTERS.

(Einfluss von Stroemungsgeschwindigkeit, Teilchengroesse und Konzentration auf die Abscheideleistung von Schwebstoffiltern). Text in German. Staub (Duesseldorf), 23 (2):69-76, Feb. 1963. 9 refs.
Fritz Banger.
Identifiers: *Flow rates, *Particle size, *Filter fabrics, Germany, Suspended particulates, Filters.

The results of 2500 measurements showed that the separation efficiency of fiber filters is dependent upon the mass concentration of the aerosol in addition to the commonly known influencing factors. This effect is a function of the suspended particulates and air efficiency groups. The maximum separation efficiency is related to the concentration limit at a given dispersion of particle sizes and the range of the maximum is set within the change of concentration by the particle sizes. The variation of the size of the particles changes the feature of the curves. Particle size, flow rate and concentration can influence the rate of the separation efficiency by a factor of 20. (Author abstract modified)
APTIC-23979

### IMPROVED PROCESS FOR OBTAINING SULPHUR FROM A GAS CONTAINING HYDROGEN SULPHIDE.

(Farbenfabriken Bayer A. G., Leverkusen (West Germany)) Brit. Pat. 207,196. 2p., Oct. 2, 1924. 1 ref. (Appl. Nov. 16, 1923, claims not given).
Personal Author Not Recorded.
Identifiers: *Silicon compounds, *Hydrogen sulfide, *Catalytic oxidation, Germany, Combustion gases, By-product recovery, Ammonia, Oxygen, Amines, Sulfur compounds, Catalysts.

A process is described for obtaining sulfur from a gas containing hydrogen sulfide by causing the gas admixed with air to react with activated silica gel. In contradistinction to the catalysts of the Claus process, silicic acid effects a smooth oxidation of hydrogen sulfide to sulfur so that the gas is completely freed from H2S. An important advantage also is that silicic acid is not oxidizable as is the case with carbon, and thus is not destroyed if the gas under treatment contains an excess of oxygen. When treating a gas very poor in H2S, it is advantageous to operate in the presence of a small quantity of a base such as ammonia or an amine.
APTIC-23980

### STOCK PILE NATURAL GAS.

Oil Gas J., 47 (53):94-96, 99, May 5, 1949. 5 refs.
Carl V. Spangler.
Identifiers: *Fuller's earth, *Natural gas, *Adsorption, *Methanes, Costs, Filters, Design criteria, Nitrogen, Cooling, Gases, Solids, Temperature.

The stock piling of methane, or natural gas, on solid adsorbents at reduced temperatures appears to be one way of solving the peak-load problem. Use of adsorbents will provide a high degree of safety, and they will be reasonably economical in comparison to other methods. Once placed in operation, the plant storing methane on adsorbents will require about the same total heat removal or refrigeration load as liquid methane. An isobar curve showing the adsorption of methane on the adsorbent, fuller's earth, is included. Fuller's earth, a Florida-Georgia type clay, is prepared as a

granular material or as a fine mesh powder, and present quotations are about $30 per ton. A schematic flow diagram indicates the gas being circulated by a compressor through a chilling device and then through a large bed of the adsorbent material. The latent heat of adsorption of methane on fuller's earth is approximately 2000 calories per mol of methane. After the refrigeration system would remove the latent and sensible heat, it would be applied to overcome heat losses of the storage system and to maintain the bed of adsorbed gas at the optimum storage temperature. Because of a narrow temperature range, rate of desorption would be comparatively rapid. Stored solid fuller's earth would be arranged in a container, and the inside walls of this container would be lined with a suitable insulating material. Safety factors are discussed, as well as the separation of nitrogen from natural gas. The bed of adsorbent would act as a large filter pad, in fact a molecular filter.
APTIC-23991

### THE FILTRATION OF PARTICLES OF ATOMIC DIMENSIONS.

Naval Research Lab., Washington, D. C.,
Chemistry Div., NRL Problem C06-06, Proj. RR 001-05-42-4851, NRL Rept. 7047, 20p., May 12, 1970. 6 refs NTIS, DDC: AD 707709
A. W. Saunders Jr., R. L. Patterson Jr., and L. B. Lockhart Jr.
Identifiers: *Particle size, *Filters, *Radioactive tracers, Deposition, Aerosols, Radiation counters, Diffusion.

Experiments are described in which a known quantity of radon gas was introduced into a 1.225-cu m chamber containing either clear air or air containing DOP aerosol particles of nominal 0.3-micron diameter. The aerosol was filtered through multiple layers of a coarse fibrous filter. Particles of atomic dimensions which become irreversibly attached to surfaces on contact were readily removed from an air stream by passage through coarse fibrous filters or through screens, whereas submicron aerosols readily penetrated such media. The inverse relationship between the efficiency of removal and the air velocity indicates that diffusion is the mechanism primarily responsible for deposition of these small particles. The great diffusivity of the atomic-sized primary radon decay products and their ready attachment to any available surfaces permits them to be used to tag aerosol dispersions and serve as a radioactive tracer for such materials, and also to be used in the absence of aerosol to study the diffusion process. The data presented indicate how the short-lived radon decay products may be employed in evaluating the efficiency of filter media. Such measurements can be extended to size ranges and to concentration levels below those which can be conveniently made by other techniques. These results also prove that atomic- or molecular sized particles (gaseous or vapor molecules) can be very simply removed from an air stream by filtration, provided that they have a large attachment coefficient for the collecting medium; however, if they become attached to aerosols, such as the normal atmospheric aerosols, much more rigorous filtration is required to prevent their penetration into a protected air space. (Author conclusions modified)
APTIC-23999

### PRECIPITATION FROM COOLING TOWERS IN COLD CLIMATES.

For primary bibliographic entry see Field 05.
APTIC-24001

### SEPARATING SOLID PARTICLES FROM GASES BY MEANS OF INERTIA FORCES.

(Die Abtrennung von Feststoffteilchen aus Gasen durch Massenkraefte) Text in German.
Verfahrenstechnik, 3 (2):51-58, 1969. 20 refs.
Ekkehard Weber.
Identifiers: *Dusts, *Centrifugal separators, *Design criteria, Germany, Operating variables, Inertial separation, Mathematical analyses, Flow rates, Pressure.

The physical laws governing dust separation in cyclones are reviewed, and simple equations are deduced which can be of help in determining the construction and dimensions of a dust separator designed to serve a particular purpose. Different designs of mechanical dust separators, principal components and the operation of a cyclone, the distribution and operation of pressures and velocities within a cyclone, secondary flows operative within a cyclone, flow patterns within a cyclone, the range of velocity ratio of medium turbulent cross-variation and radial component of main flow, particle forces and velocities, dimensions of cyclones, and rate of separation and pressure loss of a cyclone as a function of a characteristic velocity are discussed. There are many different cyclone constructions; it is irrelevant in what way gas rotation is produced, be it by a tangential, spiral, axial or radial gas supply; be it at the top, in the middle, or at the bottom of the cyclone. While the theoretical calculation of the rate of separation is exemplified on a specific example, fitting a particular cyclone to a particular job is hitherto still primarily a matter of practical experience.
APTIC-24003

### CALCULATING THE CURVE OF THE DEGREE OF FRACTIONAL DUST SEPARATION BY A CYCLONE SEPARATOR.

(Berechnung der Fraktionsabscheidegradkurve eines Zyklonabscheiders). Text in German.
Verfahrenstechnik, 3 (5):214-221, 1969. 5 refs.
(Presented at the 2nd Internen Arbeitssitzung des Gemeinschaftsausschusses 'Mehrphasenstroemungen' of the VTG and VDI-Fachgruppe Staubtechnik, Bad Homburg, April 25, 1969.)
Walter Rausch.
Identifiers: *Dusts, *Centrifugal separators, *Flow rates, Germany, Mathematical analyses.

The degree of fractional dust separation of a cyclone separator can hitherto be determined only by experiment and then only with a considerable error. For purposes of calculation, the meridian flow is first determined experimentally; from this the axial and radial components are determined. These together with the peripheral component define the flow curve of the gas. Points where the centrifugal force equals air resistance in the interplay of forces bearing upon individual dust particles in the gas flow form so-called separation surfaces with particle diameters as their parameters. Within these separation surfaces, particles are carried by the flow and are not separated; without them, particles are separated by the centrifugal force exceeding air resistance. By determining the particle orbit in the centrifugal field, a boundary particle orbit tangential to the separation surfaces can be found. If the number of particles in the inlet cross section equals 100 % and if the inlet cross section is projected into the meridian plane parallel to it, then all particles beyond the boundary particle orbit can be considered separated and all particles within as lost for dust separation. Planimetering of the surface areas will yield the degree of fractional dust separation.
APTIC-24004

### LNG AT CONSUMER'S DOORSTEP.

Am. Gas Assoc. Monthly, vol. 46, 3-5, Dec. 1964.
Personal Author Not Recorded.
Identifiers: *Storage facilities, *Natural gas, *Compressed gases, Costs, Concrete, Steel, Soils, Design criteria, Freezing.

A $12 million man-made 'natural gas well' now being constructed in the Jersey meadows across the Hudson River from New York will add 200 million cu ft to the daily gas supply available to metropolitan New York and north Jersey. Among unique features of the 165-ft deep reservoir is its use of a frozen-earth technique of storing liquefied natural gas. Because of the marshy nature of the meadowland, an area of 30-40 ft around the rim of the cylindrical walls of the inground basin had to be frozen to rock-like consistency before excavation could begin. An 8-in. casing was used in drilling holes for the freeze pipes, which consisted of 6-in. pipes closed at the bottom and containing 2-in. open-end return pipes. Cold propane was passed through the 6-in. pipes and returned through the 2-in. lines. After two months of prefreezing, a frozen wall, approximately 10-ft thick, existed around the pipes, and excavation was begun. The outside casing of the reservoir consists of a lower portion, blasted out of shale rock; an earthen portion encircled by the frozen earth; and an upper portion of concrete encased in welded steel. The entire opening is topped with an insulated steel dome. Natural gas, liquefied in a cascade cycle, will be injected into the reservoir partially in the form of a spray at the top and partially as a liquid at the bottom.
APTIC-24006

### VAPOUR INCINERATION.

Process Biochem., 5 (1):54-56, Jan. 1970.
Personal Author Not Recorded.
Identifiers: *Fumes, *Incineration, *Flame afterburners, Stack gases, Solvents, Odor counteraction, Combustion air, Oxygen, Combustion, Temperature.

Direct-fired fume incinerators should destroy most organic particles as well as organic solvent fumes, while discharge to the atmosphere from the units is odor-free. The operation principle is to pass organic pollutants through a dwell or combustion chamber where they are raised to self-ignition temperature by contact with a direct flame so that all pollutants are oxidized to carbon dioxide and water. In general, exhaust gas discharge temperatures of 1200-1400 F are sufficient to reduce pollution in effluent by 85-95%. When the oxygen content of the effluent is high, it is recommended practice to use the effluent as either primary or secondary air for the combustion process. As the oxygen content in the effluent drops below 18%, it is advisable to use an increasing percentage of fresh air as primary and secondary combustion air. When effluent is used as 'air' for the combustion of the selected fuel, the temperature of the effluent 'air' should be controlled below 700 F, if fuel gas is used, to prevent cracking; if propane or butane is the fuel selected, an effluent 'air' temperature below 650 F is recommended. Formulae are provided for calculating the net or gross heat input required for the combustion of a given volume of effluent. Burner types are mentioned, including an AH-O-, TAH-O, RAH-, and TAH-R-type burner, as well as indications for their use.
APTIC-24007

### USE OF THE COMPLEX-FORMING PROPERTIES OF METALS FOR FREEING ATMOSPHERIC CONDENSATE FROM AMMONIUM IONS.

Space Biol. Med. (English translation from Russian of: Kosmich. Biol. Med.), 4 (1):81-86, 1970. 3 refs. CFSTI: JPRS 50408
L. E. Yegorova, V. V. Krasnoshchekov, T. M. Patrikeyeva, Yu. Y. Pepelayayev, and V. F. Stolbov.
Identifiers: *Complexes, *Ion exchange resins, *Absorption, *Ammonium compounds, Ussr, Water pollution, Spacecraft atmospheres, Copper compounds, Chemical reactions, Ions, Water.

In closed systems such as spacecraft, atmospheric condensate is one of the principal sources of drinking water. It can not be used directly, however, because of the organic and inorganic impurity content. A study is made of the sorption of ammonium, one of the main components of atmospheric condensate, from water solutions by means of cation exchange resins in metal form. The relationship between the volume capacity of cationites in metal form, the ammonium concentration in the solution, and the hydrogen ion concentration is examined. The use of cationites in

metal form, and particularly in copper form, increased their ammonium capacity. Cationites in metal form can be used to purify atmospheric condensate and other aqueous solutions from all compounds containing nitrogen having an unshared pair of electrons, such as amines and amino acids.
APTIC-24011

### PROCESS FOR MANUFACTURING SULFUR FROM GASES CONTAINING SULFUR.

(Verfahren zur Erzeugung von Schwefel aus schwefelhaltigen Gasen). Text in German.
(Assignee not given.) Ger. Pat. 425664. 1p., Feb. 23, 1926. (Appl. Aug. 24, 1924, 2 claims).
Friedrich Riedel.
Identifiers: *By-product recovery, *So2 removal (combustion products), *Combustion, Germany, Combustion gases, Coal, Fuel gases, Fuel oils, Nitrogen.

In the process described for the recovery of sulfur from sulfur fumes, the sulfur-bearing gases are used as the atmosphere for combustion, with or without the addition of atmospheric air, in a burner unit utilizing oil or powdered coal as fuel. Catalysts may or may not be used. Illuminating gas, or an inert gas such as nitrogen, can be used as a carrier for the powdered coal. Sulfur is recovered in the elemental form.
APTIC-24019

### MUST WE BREATHE SULFUR OXIDES"

In: Air Pollution-1970, Part 1. 91st Congress (Senate), Second Session on S.3229, S.3466, S.3546, p. 183-189, 1970. (Hearings before the Subcommittee on Air and Water Pollution of the Committee on Public Works, March 16, 17, 18, 1970.)
Thomas K. Sherwood.
Identifiers: *Diseases and disorders, *Sulfur oxides control, Costs, Fuel criteria, Senate hearings, Air quality standards, Humans, Lung cancer, Bronchitis, Emphysema, Stack gases, Coal, Fuel oils, Electric power production, Scrubbers, Catalytic oxidation, Coal preparation, Fuel oil preparation, Absorption (general), Adsorption (general), Alkaline additives, Carbonates, Sulfur dioxide.

A review of the sources and effects of sulfur oxides emissions is presented. Published sulfur dioxide standards conclude that more than 0.1 ppm for 24 hours in any consecutive 100 day period may produce adverse health effects in particular segments of the population. People with bronchitis, emphysema, or lung cancer are highly susceptible to prolonged exposure to SO2. Upper limits on the sulfur content of fuel have been adopted, but the supply is limited. Desulfurization is practical for oils, but not for most coal. Control methods for power plant emissions include limestone injection, wet scrubbing, absorption by inorganic carbonates, adsorption on activated carbon, and catalytic oxidation. Cost estimates in terms of mills per kwh are presented. The future of sulfur control is discussed.
APTIC-24021

### THE CONTROL OF NOXIOUS GASES AND FUMES DISCHARGED FROM INDUSTRIAL UNDERTAKINGS.

World Health Organization, Copenhagen (Denmark), Regional Office for Europe, Proc. Conf. Public Health Aspects Air Pollution Europe, Milan, Italy, 1957, p. 103-130. 26 refs. (Nov. 6-14.)
W. A. Damon.
Identifiers: *Legislation, *Control methods, Commercial firms, Governments, Plant damage, Great britain, Combustion gases, Particulates, Industrial emission sources, Chemical processing, Contact processing, Electric power production, Primary metallurgical processing, Textile manufacturing, Transportation, Vehicles, Electrostatic precipitators, Packed towers, Absorption, By-product recovery, So2 removal (combustion products), Absorption (general), Alkaline additives, Peter spence process (claus), Hydrochloric acid, Hydrofluoric acid, Chlorides, Chlorine, Fluorine, Nitrogen oxides, Sulfur oxides, Hydrogen sulfide.

The greatest contribution to air pollution arises from the combustion of fuel for domestic and industrial purposes and from motor traffic. Its damaging effects include injury to plants, deterioration of property, and possible or proven hazards to the health of humans and animals. British air pollution legislation is embodied mainly in three Acts of Parliament: the Alkali etc. Works Regulation Acts, first enacted in 1863; the Public Health Acts, 1936; and the Clean Air Act, 1956. Evolution of the chemical industry has caused a variety of changed and new pollutants. Fluorine compounds can be washed in alkaline solutions, followed by electrical precipitation. The escape of SO2 from the exits of sulfuric acid plants depend on the efficiency with which the the process is conducted. In four stage contact plants burning brimstone, recourse to scrubbing the exit gas with either soda or ammonia may be necessary. Power stations remove SO2 from waste-fuel gases by scrubbing with slightly alkaline water. Sulfur dioxide arising from the roasting of copper as in the production of iron oxides is normally absorbed by passage through towers packed with limestone. Hydrogen chloride may be recovered at a useful strength by arranging a counter current series of absorbers. Hydrogen sulfide may be scrubbed with caustic soda to produce sodium sulfide; it may be absorbed by passage through hydrated iron oxide which can be regenerated to produce spent oxide containing up to 50% sulfur; or it can be stripped out by means of a solvent and regenerated in concentrated form for treatment in a Claus Kiln. Gases containing chlorine may be scrubbed with an alkaline solution or by contact with milk of lime; passage through a tower packed with scrap iron is also effective. Nitrogen peroxide may be recovered in the form of nitric acid by water washing; but for every three molecules of nitrogen peroxide thus absorbed there is evolution of one molecule of nitric oxide which must be reoxidized to nitrogen peroxide.
APTIC-24033

### THE CHRYSLER CLEANER AIR SYSTEM FOR 1970.

Preprint, Society of Automotive Engineers, Inc., New York, 12p., 1970. 11 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 12-16, 1970, Paper 700151.)
R. E. Goodwillie, N. M. Jacob, and E. W. Beckman.
Identifiers: *Automotive emission control, Standards, Emission standards, Blowby, Crankcase ventilation air, Carburetor evaporation losses, Internal combustion engines, Automobiles, Air-fuel ratio, Spark timing, Engine design modification, Design criteria.

The Chrysler Cleaner Air System of exhaust emission control for 1970 includes modifications in the engine, carburetor, ignition system, and other related components. Extensive carburetor development to obtain good idle and part throttle fuel-air distribution was carried out on dynamometer engines during the 198 engine development program. Stroke increase of the new 198 CID engine resulted in a larger cylinder size, a lower combustion chamber surface area to volume ratio, and an increase in stroke bore ratio. A reduction of .4 to .5 in compression ratio was made in the majority of the V-8 engines, while the slight fuel economy and performance losses resulting with the reduced compression ratio were offset by fuel-air distribution improvements and the ability to set the spark timing closer to the maximum output spark advance. Heated intake air to the carburetor has been provided, and to provide further improvements in starting and driveability, several changes were made in the intake manifolds. Some of the carburetor changes that were made to improve distribution are by-pass idle air systems in the throttle flanges, idle fuel feed in the by-pass air system, optimum location and direction of discharge from the crankcase ventilation system, and the use of an offset main venturi. A major change has been made in the mounting of the remote choke thermostatic coil units. An explanation of the reduced hydrocarbon emissions obtained with the single plane intake manifold is based on the cycle-to-cycle fuel-air delivery to the cylinders. Solenoid actuation was chosen for spark retard at idle. Design changes in the distributor are discussed, as well as advantages in coolant temperature and idle settings. An appendix includes the engine dynamometer test schedule, while emission test results are indicated throughout.
APTIC-24040

### THE ROLE OF THE CYCLONE IN REDUCING ATMOSPHERIC POLLUTION.

Chem. Ind. (London), 1955:1324-1330, Oct. 15, 1955. 5 refs. (Presented at the Society of Chemical Industry, Prevention of Atmospheric and Water Pollution in the Chemical Industry Symposium, London, April 4-5, 1955.)
C. J. Stairmand, and R. M. Kelsey.
Identifiers: *Dusts, *Centrifugal separators, Great britain, Stack gases, Fly ash, Boilers, Electrostatic precipitators.

Some methods of predicting the performance of cyclone dust arrestors under various conditions, and hence assessing the value of the equipment for a given duty have been given. The suitable method for comparing the absolute performances of different collectors is in terms of the collection efficiency for each of various particle -size groups. In considering the probable effect of final discharge to the atmosphere, the mass emission of the various sizes of particles is of primary importance, as overall collection values may be misleading. Typical grade-efficiency curves are provided for the four groups of dust arrestor under consideration, and the performance of each of the four types of collector in removing the fly ash from a stoker-fired boiler is considered. The four main types of cyclone dust or grit arrestor include the simple dust collecting fan, the medium-efficiency or high-throughput cyclone, the high-efficiency cyclone, and the multicyclone. From a knowledge of the size grading of the particles emitted from a stack, it is possible to calculate the dust deposition rate in the neighborhood of the stack, taking account of the meteorological conditions in the ambient atmosphere. Projected area values are given for the inlet dust and for the exit dusts from the four schemes considered, to assess the probable improvement in the appearance of the plume after fitting dust arrestors. high-efficiency cyclones in conjunction with electrostatic precipitators is mentioned, as well as the use of cyclones in a series. Small cyclones are suggested to be more efficient than the larger ones, but much of the theoretical advantage may be lost in service by partial plugging of the cyclone inlet and exit ducts.
APTIC-24043

### RECENT DEVELOPMENTS IN EXHAUST MANIFOLD REACTOR SYSTEMS.

Preprint, Inst. of Mechanical Engineers, London (England), Automobile Div., 18p., 1970. 11 refs. (Presented at the Institute of Mechanical Engineers, Automobile Division Meeting, London, England, May 11, 1970, Paper AD P13 (B)/70.)
E. N. Cantwell, I. T. Rosenlund, W. J. Barth, and S. W. Ross.
Identifiers: *Afterburners, *Engine design modification, *Design criteria, Engine exhausts, Automobiles, Engine operation modification, Hydrocarbons, Carbon monoxide.

Exhaust emission control systems employing air injection and exhaust manifold reactors in place of conventional exhaust manifolds have been developed to control vehicle emissions to 0.25 gram (20 ppm) of hydrocarbons and 5.0 grams (0.22 per cent) of carbon monoxide per mile. These low emission levels have been achieved with good driveability, good vehicle performance and very little loss in fuel economy. Durability tests of a

number of exhaust manifold reactor systems indicate that acceptable life in consumer service can be attained. Non-nickel alloy steels developed by specialty steel manufacturers, and based on the iron-chromium-aluminium system, appear to be useful materials of construction for reactors. These alloys coupled with the now demonstrated simplifications in reactor design offer one route to lower ultimate costs of these units. The commercial development and application of exhaust manifold reactor systems seems entirely feasible. Considering the fact that reactors can be built to last 100,000 miles without maintenance, and also considering that the logical development of thermal reactors will result in their becoming an integral part of the engine instead of a tack-on device, it is almost certain that such a system will give the best overall economic value to the motorist in the long run. (Author abstract modified)
APTIC-24047

## PRESENT STATUS OF SULPHUR FIXATION AND PLAN OF INVESTIGATIONS.

Bureau of Mines, Washington, D. C.,
Metallurgical Div., Rept. of Investigations 3339, p. 3-19, May 1937. 14 refs.
R. S. Dean.
Identifiers: *So2 removal (combustion products), Stack gases, Electric power production, Primary metallurgical processing, Stacks, Electrostatic precipitators, Filters, Scrubbers, Bubble towers, Packed towers, Absorption (general), Alkaline additives, Dispersion, Ammonium compounds, Aluminum compounds, Sodium carbonate, Amines, Sulfates, Sulfites, Reduction.

A review of the present technical status of sulfur dioxide control is presented. The problem is broadly met in one of two ways: dilution in the atmosphere, and by converting the SO2 to a liquid or solid and disposing of it in that form. No satisfactory proocess for recovering sulfur without preliminary concentration is known. Three processes for such concentration are known. They use as absorbents ammonium sulfite-bisulfite, basic aluminum sulfate, and xylidine and sodium carbonate solution. The formation of sulfate is a major problem in all three processes. It is removed as calcium sulfate in the first two and sodium sulfate in the third. The reduction step presents fewer problems than the concentration step. All three processes require cooling the stack gases. Investigations are recommended to improve these processes, and the development of an amine process that would show less reagent loss and satisfactory removal of sulfate is suggested. (Author summary modified)
APTIC-24048

## THE THIOGEN PROCESS FOR REMOVING SULPHUR FUMES.

Met. Chem. Eng., 16 (6):309-310, March 13, 1917.
Personal Author Not Recorded.
Identifiers: *By-product recovery, *So2 removal (combustion products), *Reduction, Combustion gases, Fumes, Barium compounds, Calcium compounds, Sulfur compounds, Sulfides, Catalysis.

Two versions of the thiogen process for converting sulfur dioxide fumes to commercial sulfur are described. The dry process reduces SO2 with hydrocarbon vapors and in contact with calcium sulfide. A pilot operation on a commercial scale was initiated but was aborted prior to completion by unrelated financial difficulties. The dry method is believed to be the more economical of the two, though, to date, its application has been limited to rather high concentrations of SO2 (greater than 7%). The wet method involves the dissolving of the SO2 in water and precipitating the sulfur out with barium sulfide. Barium sulfide was chosen over the cheaper calcium sulfide due to its rapid dissolving the water and the fact that the barium salts formed in the process precipitate out more readily and do not retain water of crystallization as the calcium salts do. Heating economies are effected by not having to drive off the water of crystallization during the drying process.
APTIC-24049

## THE INERTIAL MECHANISM IN THE MECHANICAL FILTRATION OF AEROSOLS.

J. Colloid Sci., vol. 6:416-428, 1951. 8 refs.
Eugene A. Ramskill, and Wendell L. Anderson.
Identifiers: *Filters, *Aerosols, *Inertia, Particle size, Mathematical analyses, Density.

The inertial mechanism was shown to definitely exist and play an important role in the mechanical filtration of aerosols at lower particle radii than calculated by Albrecht and Langmuir. Limitations, assumptions, mechanisms, and conclusions of Langmuir's theory which includes only direct interception and diffusion are presented. A series of varied filters was selected for experimental investigation, and determination of the penetration-velocity curves for various aerosols was made for each filter. Resistance measurements, the effect of aerosol size, aerosol density, filter fiber diameter, and interfiber distance, were also considered. The regular manner in which the penetration-velocity curves vary with particle radius, particle density, and fiber diameter suggested that a mathematical relation should exist which would quantitatively express the inertial effect.
APTIC-24056

## METHOD FOR THE REMOVAL OF OXIDES OF SULFUR FROM FLUE GASES.

(Verfahren zum Entfernen von Schwefeloxyden aus Rauchgasen). Text in German. (Simon-Carves Ltd., Stockport (England)) West Ger. Pat. 1,056,771. 2p., May 6, 1959. (Appl. July 29, 1955, 2 claims).
Harold Earle Newall.
Identifiers: *Ammonium compounds, *Alkaline additives, Great britain, Combustion gases, Scrubbers, Packed towers, So2 removal (combustion products).

Sulfur oxides are removed from flue gas by washing in a circulating aqueous solution of ammonium salts to which ammonia is being added in several consecutive steps in quantities corresponding to the prevailing absorption requirements. First, a concentrated ammonium salt solution is added, followed by gradually more and more diluted additions until the last addition contains a solution of a concentration which is no higher than one twentieth of the original concentration. The operation is carried out in a 2 chamber scrubber with the flue gases entering at the bottom and the washing fluid kept in circulation by a pump being sprinkled on packing material from above. The concentration of the washing liquid is maintained by the addition of ammoniacal water. The original concentration of 0.06 to 0.07 % sulfur oxides by volume in the flue gas is reduced by the first step of the scrubbing operation to 0.008 to 0.011 % and by the second step, to 0.001 to 0.003 % which represents a separation efficiency of 95 to 98%. Ammonium loss is no more than 0.003 to 0.007 % of the volume of the washed gas.
APTIC-24062

## ELECTRICAL CLEANING OF WASTE GASES FROM ELECTRODE FURNACES.

(Elektrische Reinigung der Abgase aus Elektrodenbrennoefen). Aluminium, 43 (3):171-174, March 1967. 4 refs. Translated from German.
Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 16p., Nov. 4, 1969.
G. Schiele.
Identifiers: *Mists, *Electrostatic precipitators, *Coal tars, Germany, Odors, Kilns, Design criteria, Cooling, Voltage, Vapor pressure.

Flue-gas of electrode firing kilns contains extremely fine tar mists of fractions having different boiling points. Particularly during temperature inversion conditions, the usually disagreeable odor can constitute a great nuisance in both the closer and more distant environment. On account of its fineness, the mist can be separated most effectively by electrostatic filters. The higher the operating voltage of the electrostatic filter, the better is the separation. However, the voltage cannot be raised arbitrarily high, since it will ultimately lead to electrical discharges between the spray and the precipitation-electrodes. One should strive to cool the flue-gas before tar separation to such an extent that the renewed condensation of tar mists after cleaning is as slight as possible. At a temperature of about 70 C, the vapor pressures of the tar oils in question are already so low that, on dilution of the flue gas with atmospheric air and on cooling of the mixture, they remain in the aerosol form and evaporate very rapidly. Methods of cooling are discussed, as well as effective means of controlling the danger of fire.
APTIC-24065

## DUST COLLECTOR.

Day/ton Progress Corp., Dayton, Ohio) U. S. Pat. 3,525,183. 5p., Aug. 25, 1970. 6 refs. (Appl. July 17, 1967, 11 claims).
Robert J. Gargrave.
Identifiers: *Dusts, *Collectors, *Exhaust systems, *Design criteria, Particulates, Fumes, Metal fabricating and finishing, Vapors.

An apparatus for collecting dust, vapors and solids produced in the operation of grinders and various cutting tools is described, which comprises a funnel-like hood unit having a base adapted for an attachment to embrace the working area of a cutting tool. The hood is made of transparent material to facilitate viewing while also providing a working shield. Its funnel-like design affords an optimally contoured unobstructed passage for waste materials to be free to move longitudinally through the collector hood and to be accelerated in passage. A pump exerts a condition of low pressure in the collector hood which in turn induces a flow of ambient air to the entrance end of the hood.
APTIC-24074

## CONSERVING OUR ENVIRONMENT: WHAT CHEMICAL ENGINEERING CAN AND SHOULD DO.

Chem. Engr. (London), no. 240:CE204-CE210, July-Aug. 1970. 27 refs. (Presented at the 48th Annual General Meeting of The Institution of Chemical Engineers, Birmingham, England, April 21, 1970.)
H. Hoog.
Identifiers: *Petroleum refining, *Water pollution, *Control methods, Great britain, Stack gases, Sources, Natural gas, Gasolines, Steam plants, Stacks, Hydrodesulfurization, So2 removal (combustion products), Tetraethyl lead, Compressed gases.

Various types of pollution are considered with respect to their sources, effects, and the application of chemical engineering to their control. The types are air, rivers and lakes, oceans, soil, solids pollution, and noise and light. A general procedure is presented for minimizing pollution from new plants and specific examples are given of pollution control in the petroleum industry. Practices recommend for new plants include site-selection studies; pre-operational studies to establish a base level of noise and of air and water quality; optimization studies of alternative processes; and attention to pollution-conscious design, engineering, and construction. Specific measures for controlling air pollution from petroleum production include tall stacks, use of liquefied natural gas for power-generation plants, fuel-oil and flue-gas desulfurization, and removal of lead from gasolines. Water pollution by oil can be reduced by reusing process water, reducing effluent water by gravity separation or by air cooling followed by trim water cooling, and complete segregation of drainage systems for clean and oily water. Discharge of oil at sea is curtailed by the 'load on top' procedure. In this procedure, the mixture of oil and water produced by cleaning tanks at sea is separated in a special slip tank. After separation the clean water is pumped out and the next cargo loaded on top.
APTIC-24080

### ARREST EFFICIENCY ON CUPOLA ARRESTER IN WATER SPRAY TYPE.

(Kyupora no shishiki jojinsochi no jojinkoka ni tsuite). Text in Japanese. Imono (Foundry), 42 (9):734-735, Sept. 25, 1970. 4 refs.
Hiroto Mitsubashi, Hiroshi Yoshioka, Kaoru Komatsu, and Kazuo Ueta.
Identifiers: *Cupolas, *Collectors, *Spray towers, Japan, Dusts, Particle size, Calcium compounds, Oxides, Aluminum oxides, Silicon dioxide, Flow rates.

Several types of cupola dust collectors, including the one of standard size proposed by F. M. Shaw were tested for their efficiency at a plant site. The collectors were attached to a cupola of 580 mm tuyere inner diameter and 1.8 t/hr melting capacity. Collected dust was led to a sedimentation tank through a pipe. Stray dust was captured by a dust tube on top of the collector. The dust was found to be predominantly silicon dioxide, which constituted 45% of the total weight. Aluminum oxide and calcium oxide totaled 4%. The particle size distribution had its peak at 65 mesh, 12-22% of the total weight. Two to seven per cent of the particles were above 270 mesh. The strayed dust particles ranged between 2 and 20 micron. When the standard size dust collector was used in combination with a water spray, dust removal efficiency of 86.5% was obtained at an 80 l/min rate of water consumption. The stray dust amounted to 0.815 g/N cu m. At an optimum combination of collector and spray nozzle, the maximum efficiency of 96.8% was reached. Good results were obtained with a water spray of 70-120 l/min; below 70 l/min the efficiency rapidly dropped. A rule of thumb for the efficient supply of water was 3-4 times of the amount of air supply. A future hydraulic study of water vapor formation will lead to a more efficient dust collector of simpler construction.
APTIC-24082

### HYDROCARBON OIL DESULFURIZATION METHOD.

(Tanka suiso abura no dassui hoho). Text in Japanese. Fuji Engineering Co., Ltd. (Japan) Japan. Pat. Sho 45 13459. 4p., May 5, 1970. (Appl. Nov. 26, 1966, claims not given).
Toru Togawa.
Identifiers: *Fuel oils, *By-product recovery, *Desulfurization of fuels, Japan, Ammonium compounds, Hydrogen, Hydroxides, Sodium compounds, Hydrogen sulfide, Temperature.

This invention offers an effective method for desulfurization of crude oil, its distillate or residual oil. In the method, crude oil or its distillate or residual oil with or without addition of caustic alkali is heated to over 100 C. Then, the solution obtained by dissolving metallic sodium in liquid ammonia at temperature below normal is added and mixed uniformly into the oil, the added quantity being 40% or less of the oil by weight. The mixture is then heated to over 200 C while adding steam thereto, so that total quantity of the metallic sodium may be reduced to caustic soda and hydrogen, and sulfuric content of the oil may be separated out as their compounds, $(NH_4)_2S$, $Na_2S$, $H_2S$, etc., by synthetic action of hydrogen from the caustic soda generator. Among the advantages it offers are; dissolved in liquid ammonia, the metallic sodium is safe and easy to handle as a solution, it is easy to mix uniformly with the oil, and desulfurization is accomplished in three stages, by ammonia, caustic soda and hydrogen of the generator. The substances formed by the reactions are gaseous or water soluble, and thus do not clog the piping system.
APTIC-24083

### METHOD AND APPARATUS FOR RECLAIMING WASTE INDUSTRIAL OILS.

(Wallover Oil Co., East Liverpool, Ohio) U. S. Pat. 3,527,696. 3p., Sept. 8, 1970. 5 refs. (Appl. Dec. 17, 1969, 14 claims).
James I. Wallover.
Identifiers: *Industrial oils, *By-product recovery, Centrifugal separators, Filters, Spray towers, Gravity settling.

Past attempts to reclaim industrial oils (e.g., gear oil, hydraulic pressure oil, quenching oil, transfer oil, mineral spirits, and kerosene) have been too expensive and have produced problems of disposal of waste products removed from the oils. On the other hand, a much greater disposal problem is presented if reclamation is not attempted and the waste oil is merely dumped. The invention reported provides a relatively uncomplicated method and apparatus for reclaiming waste oils at a cost that makes reclamation worthwhile. Industrial oil is first pumped to a settling tank from which solids and liquids are drawn off. To remove any remaining solids and water, the oil in the tank is passed through a heat exchanger to a centrifuge and then delivered to the top of a filtering tank. In the bottom of the tank there is a bed of activated earth, such as fullers earth, bauxite, or alumina that will remove chemicals and extremely small foreign particles from the oil. For best results, the activated earth should be of a size to pass through a 60-90 mesh screen. The filtered oil is then conducted to a vacuum still, where it is distributed to produce clean oil and distillates. For cleaning and reactivation, the spent earth in the filter bed is removed periodically and passed through an incinerator. Its place in the filtering tank is taken by earth delivered from a substantially air-tight reservoir, to which reactivated earth from the incinerator is returned. The smoke produced by the incinerator is burned and the resulted gas are scrubbed to remove solids, which are collected for suitable disposal.
APTIC-24085

### PORTABLE AIR FILTER.

(Assignee not given.) U. S. Pat. 3,523,409. 3p., Aug. 11, 1970. 12 refs. (Appl. Aug. 26, 1968, 2 claims.)
Werner A. Paterson.
Identifiers: *Portable, *Dusts, *Filters, Microorganisms.

Existing filters with support frames and blowers are permanently installed and usually used in connection with duct work for furnaces and buildings. To provide for a similar velocity of air entering and leaving the filters, inlet air openings and outlet air openings are usually of a similar size. When the effective filter surface area is also of a similar size, the high velocity of air passing through it significantly reduces the efficiency of the filter. The portable filter of the invention, which can be used in any room of a house or in a laboratory, is supported in a metal box containing an air outlet in communication with the blower. The effective area of the filter is many times larger than the area of the air outlets so that the velocity of the air moving over the filter is low. The entire unit is, therefore, efficient in filtering dust from air. If desired, the filters can be chemically treated to remove bacteria and germs.
APTIC-24087

### ADVANCES IN FLY ASH REMOVAL WITH GAS-SCRUBBING DEVICES.

Filtration Eng., 1 (7):12-15, March 1970.
Ralph R. Calaceto.
Identifiers: *Multiple chamber incinerators, *Sludge, *Venturi scrubbers, Sewage, Afterburners, Design criteria, Cooling.

The adoption of the mutiple-hearth furnace in servicing sludge incineration has offered the prime advantage over other devices in that counter-flow feed of wet sewage cake to the exhaust gases creates a progressive drying as the sludge descends from hearth to hearth and, finally, into the burning or incineration zone. A very simple scrubber, which consisted of an enlarged duct with sprays that partially cooled the gases, was the first gas-cleaning device to follow the multiple-hearth furnace. In recent years, new multiple-hearth furnaces have been designed to include afterburners, to assure complete combustion prior to scrubber treatment of such volatiles as grease and tar vapor. Within the past year, a new device, the Mikro-Airetron venturi scrubber was installed at the sludge incinerator plant in Orangeburg, New York. The fine droplets created by the carefully monitored gas acceleration combine and coalesce with the fly-ash particles, removing particles down to sub-micron size. Operation of this venturi scrubber is described. The Orangeburg installation is also provided with a cooling stage, just following the venturi, which serves to reduce the usual saturation temperature of 170 to 185 F down to 110 F.
APTIC-24089

### HIGH-ENERGY AIR FILTER FOR REDUCING INDUSTRIAL EFFLUENTS.

Filtration Eng., 1 (9):9-13, May 1970.
Personal Author Not Recorded.
Identifiers: *Asphalt, *Smokes, *Industrial emission sources, *Filters, Costs, Odors, Particulates, Droplets, Glass fabrics, Design criteria Phenols, Formaldehydes.

Faced with a tacky organic smoke emission from two of its major processes, asphalt saturation and the baking of phenolformaldehyde binders, Johns-Manville set about developing a technique for dealing with the effluent. The key to the process developed, called HEAF, for high-energy air filter, is the utilization of high velocity effluent air through a fiberglass filter medium. Increasing efficiency is due either to an increase of inertial forces, which throw the particle against the fibers and capture it by that mechanism, or by compression of that material at higher flow rates and pressure drops. It has rarely been reported that odors are due to particulates, but the results obtained with the two effluents tested seem to indicate that the liquid particulates in these effluents are almost the sole cause of odor. If this were not so, there would not be such a close correlation between the odor-removal efficiency and the particulate-removal efficiency. An economic comparison of seven different systems designed to filter 30,000 cu ft per minute from a roofing plant saturator is presented tabularly.
APTIC-24090

### IGNITION SYSTEM PERFORMANCE CAN AFFECT EXHAUST EMISSIONS.

SAE-Australasia, 30 (4):128-135, 1970. 6 refs.
(Presented at the Vehicle Exhaust Symposium, Auckland, New Zealand, April 15, 1970.)
George M. Galster.
Identifiers: *Ignition system, *Engine exhausts, *Spark ignition engines, Operating variables, Filters, Carburetion, Spark timing, Hydrocarbons.

The effects of automotive ignition system malfunctions on exhaust emissions, gasoline mileage, and performance are discussed. All available data indicate that a plug misfire can triple the unburned hydrocarbon emission level. This is all the more serious due to the fact that the average driver can be unaware of as much as 20% misfire. The phenomenon of tracking ignition is described and some spark plug design modifications intended to overcome or minimize both fouling misfires and tracking ignition are listed. Results of surveys indicate an unbelievably low level of ignition system maintenance among motorists, in spite of the fact that replacing plugs with 10,000 miles driving time with new plugs can save an average of twenty percent in fuel costs in addition to significantly reducing harmful emissions. Plugs are the most serious offenders in ignition system malfunction, the quickest component to deteriorate, but the easiest to replace. Other significant factors include idle speed adjustment, point gap, ignition timing, and the accumulated dirt in the air filter.
APTIC-24093

### THERMODYNAMICS OF REDUCTION OF SULFUR DIOXIDE BY METHANE.

J. Appl. Chem. USSR (English translation from Russian of: Zh. Prikl. Khim.), 43 (1):32-38, Jan. 1970. 10 refs.
T. D. Averbukh, A. A. Radivilov, and N. P. Bakina.

Identifiers: *So2 removal (combustion products), *Methanes, *Reduction, *Thermodynamics, Ussr, Combustion gases, By-product recovery, Sulfur compounds, Hydrogen sulfide, Catalytic activity, Pressure, Temperature.

A thermodynamic study of reduction of sulfur dioxide by methane in the 1000-1500 K temperature range at SO2:CH4 ratios of 1.0-2.5 and pressures of 0.15-1.0 atm showed that at n equals 2.0, the yield of elemental sulfur is maximal. Reaching 58% under 1 atm pressure at 1000 K and 71% at 1500 K, the sulfur yield increases slightly with decreasing pressure. At n equals 1.0, high yields of hydrogen sulfide are obtained in the 1000-1200 K range. Reduction of sulfur dioxide by methane should not be accompanied by soot formation when equilibrium conditions are attained. Reduction of sulfur dioxide by methane may be an effective method for producing elemental sulfur, provided that the process includes low-temperature catalytic stages for conversion of by-product sulfur compounds into sulfur (by interaction with sulfur dioxide).
APTIC-24098

### REDUCTION OF SULFUR DIOXIDE BY METHANE IN PRESENCE OF CARBON AND BY CARBON IN PRESENCE OF STEAM.

J. Appl. Chem. USSR (English translation from
Russian of: Zh. Prikl. Khim.), 43 (2):237-244, Feb.
1970. 9 refs.
T. D. Averbukh, A. A. Radivilov, and N. P.
Bakina.
Identifiers: *So2 removal (combustion products), *Methanes, *Reduction, *Thermodynamics, Carbon black, Ussr, Combustion gases, By-product recovery, Carbon disulfide, Hydrogen sulfide, Catalytic activity, Steam, Pressure, Temperature.

A thermodynamic study of reduction of sulfur dioxide by methane in the presence of carbon in the 1000-1500 K temperature range at SO2:CH4 ratios from 1.0 to 2.5 and under pressures from 0.15 to 1.0 atm showed that under 1 atm pressure with n equals 1, the equilibrium yield of hydrogen sulfide reaches 93% at 1000 K and 48.5% at 1500 K; under 1 atm pressure with n equals 2.5, the equilibrium yield of carbon disulfide reaches 62% at 1500 K. A thermodynamic study of reduction of sulfur dioxide by carbon in the 1000-1500 K temperature range at SO2:H2O ratios from 6 to 100 and under pressures from 0.15 to 1.0 atm showed that the equilibrium yield of CS2 reaches 70-80% at 1300-1500 K; the reaction of its formation is represented by the overall equation 5C plus 2SO2 equals CS2 plus 4CO. The thermodynamic conditions are unfavorable for the industrial use of either process for production of carbon disulfide (and of the first process also for production of H2S), mainly because they are highly endothermic. Industrial coke plants for production of elemental sulfur operate under nonequilibrium conditions.
APTIC-24100

### WET COLLECTORS.

Can. Mining J., 91 (10):80-85, Oct. 1970.
F. Malozzi.
Identifiers: *Particulates, *Operating variables, *Scrubbers, Canada, Particle size, Impingers, Centrifugal separators, Packed towers, Spray towers, Venturi scrubbers, Wet cyclones, Inertial separation, Design criteria, Particle growth, Gases, Temperature.

The principles of wet collection and the effectiveness of wet collectors in removing particulate matter from a gas stream are reviewed. Five factors are identified as influencing collection: concentration, specific gravity, shape, temperature, and agglomeration. Of these, concentration is by far the most significant, with temperature rating second. The forces used to effect collection are reviewed and related to types of equipment. Wet collectors use a combination of centrifugal force, impaction, and impingement in various sequences to perform in different situations. The various types of wet collectors are reviewed in ascending order of pressure drop. Spray chambers and spray towers provide the lowest pressure drop and, correspondingly, the lowest efficiencies of collection. The medium pressure drop group includes wet centrifugal collectors, wet dynamic precipitators (not to be confused with electric precipitators), orifice-type or atomizing inertial collectors, atomizing impingement collectors, and packed towers. The principal occupant of the high pressure drop group (10 in W. G.) is the venturi type collector. While this unit provides high collection efficiency where it can be used, the pressure drop represents a significant cost item in that pumps or fans must be purchased, operated, and maintained to keep the gas flowing through the system. Some considerations pertinent to collector selection are presented; the importance of routine preventative maintenance is stressed, as is the requirement to relate the selection of a collector to the job that has to be done. Some advantages of wet collectors are listed.
APTIC-24102

### METHOD OF SULFURIC ACID MANUFACTURE.

(Parsons (Ralph M.) Co., Los Angeles, Calif.) U.
S. Pat. 3,525,587. 4p., Aug. 25, 1970. 3 refs. (Appl.
July 19, 1968, 12 claims).
Timothy J. Browder Jr.
Identifiers: *Catalytic oxidation, *Absorption (general), *Sulfuric acid, Combustion gases, Operating variables, By-product recovery, Heat transfer.

A process is described for the production of sulfuric acid by the catalytic oxidation of sulfur dioxide containing gas and the multiple stage absorption of sulfur trioxide produced by such catalytic oxidation. Sulfur dioxide containing gas can be produced by a variety of reactions, such as by the oxidation of hydrogen sulfide or hydrocarbon mercaptans, or by metallurgical smelting. Conventional multiple oxidation stage processes which utilize intermediate absorption between stages are deficient in that they fail to allow the desired flexibility of initiation of optimum inlet or exit temperatures for each of the oxidation stages. The present method utilizes a portion of the exothermic reaction heat of gas exiting from the first of at least three successive oxidation stages, having an intermediate absorption stage between the second and third stages for pre-heating gas passing into the third oxidation stage. Exit gas from the first oxidation stage is preferably split into two streams; one stream is fed to a heat exchanger for pre-heating gas to be fed into the first oxidation stage, and the other stream is utilized to pre-heat gas passing from the intermediate absorption stage to the third oxidation stage.
APTIC-24103

### CHARACTERIZATION AND CONTROL OF GASEOUS AND PARTICULATE EXHAUST EMISSIONS FROM VEHICLES.

For primary bibliographic entry see Field 03.
APTIC-24107

### RECOVERY OF SOLUBLE GAS AND AEROSOLS FROM AIR STREAMS.

Ind. Eng. Chem., 46 (9):1769-1777, Sept. 1954. 18
refs.
Edward M. Berly, Melvin W. First, and Leslie
Silverman.
Identifiers: *Aerosols, *Packed towers, *Absorption, *Gases, Stack gases, Dusts, Droplets, Mists, Particle size, Glass fabrics, Screen filters, Hydrofluoric acid, Sulfuric acid, Ammonium compounds, Aluminum compounds, Condensation, Flow rates, Pressure.

High efficiency absorpiton of soluble or reactive gases was obtained with wetted fiber beds. Wetted fibers were five to 10 times more efficient than Raschig rings or Berl saddles, compared on the basis of equal volumes. When compared on the basis of weight of packing, 1 pound of 78-micron-diameter saran fibers was 75 times more effective for the absorption of hydrogen fluoride gas than 1 pound of 1/2 inch Berl saddles. In addition to hydrogen fluoride gas, cleaning efficiency for sulfuric acid and ammonium bifluoride mists, ammonium bifluoride and aluminum chloride fumes, and silica, talc, and atmospheric dusts was investigated. High efficiency collection (greather than 99.9%) generally required the addition of a droplet eliminator composed of a 1- to 2-inch depth of dry fibers less than 5 microns in diameter. Although absorption of the gas was complete, a significant quantity of fluorides passed the scrubber in the form of fine (less than 10 micron) mist droplets formed from condensation of hydrogen fluoride gas in the humid atmosphere of the scrubber or from fine droplets formed by the sprays. When gas streams containing inert particles were treated, the absorbing stages were protected from fouling and plugging by the use of an impingment device such as a Neva-Clog screen as a prefilter. Over-all resistance of the scrubber was proportional to the flow rate. For gas flows of 200 cu ft/min, sq ft of scrubber face area, high efficiency scrubbing of gas and submicron particulate matter was obtained with resistances not exceeding 6 inches of water gauge. For atmospheric pollution control of stack gas, emissions resistances less than half this may be adequate. (Author summary)
APTIC-24110

### A TOTAL EXHAUST EMISSION CONTROL SYSTEM.

Preprint, Air Pollution Control Assoc., New York
City, 14p., 1970. 5 refs. (Presented at the Air
Pollution Control Assoc., Ontario and Quebec
Chapters Joint Meeting, Montebello, Quebec,
Sept. 20-22, 1970.)
E. N. Cantwell.
Identifiers: *Engine exhausts, *Engine operation modification, *Engine design modification, Operating criteria, Emission standards, Particulates, Gasolines, Automobiles, Afterburners, Hydrocarbons, Carbon monoxide, Nitrogen oxides.

A total exhaust emission control system is described which will meet the 1975 exhaust emission standards proposed by the U. S. government. (All emission standards or goals and reported emission levels are those determined by The Federal Test Procedure for 1970 model cars.) These proposed standards can be met without any changes in present-day fuel composition and, more specifically, without restrictions on the use of lead antiknocks. Data which gives promise that the 1980 goal for exhaust emissions also can be met with further development of the system is presented. The total emission control system combines three major devices. These are: an exhaust manifold thermal reactor to control the hydrocarbons and carbon monoxide to very low levels. This device has the capability of controlling emissions for the normal lifetime of the car without attention or maintenance; an exhaust gas recirculation system to control nitrogen oxide levels. Although not yet tested as extensively as exhaust manifold reactors, the exhaust gas recirculation system has been operated for 50,000 miles without maintenance; and an exhaust trapping system to control particulate matter in the exhaust. These trapping systems also have not been tested as extensively as exhaust manifold reactors but various versions have been operated for up to 64,000 miles without maintenance or attention. (Author abstract modified)
APTIC-24112

### ATMOSPHERIC POLLUTION.

For primary bibliographic entry see Field 01.
APTIC-24115

### ATMOSPHERIC POLLUTION.

Ind. Eng. Chem., 47 (8):95A-96A, Aug. 1955. 1 ref.
Louis C. McCabe.

Identifiers: *Aluminum, *Primary metallurgical processing, *Collectors, *Process modification, Fumes, Exhaust systems, Spray towers, Hydrofluoric acid, Aluminum oxides, Reduction, Electrolysis.

In the electrolytic reduction of alumina, oxygen libertated in the cryolite bath combines with the carbon of the node to produce carbon dioxide. As the CO2 rises through the blanket of alumina covering the electrolytic cells, small amounts of alumina dust and fluorides are entrained. On striking the air the fluorides are hydrolyzed, in part, to hydrogen fluoride gas. Heat generated in the reduction process requires that effective ventilation be maintained to provide satisfactory working conditions in the potrooms, but the high velocities of an induced draft pick up some of the fine dust from the top of the pots. The collecting systems consist basically of a dry type dust separator, an induced draft fan, and a wet scrubber. A typical system of this type uses a drv dynamic precipitator exhauster that is so designed that the dust is separated from the main gas stream within the fan by means of specially shaped blades and a separate outlet in the scroll. The main gas stream, containing some fine dust, is discharged directly to an open tower type scrubber of redwood construction with suitable spray headers. At one large plant, the basic system has been supplemented by an electrostatic precipitator. Fumes generally can be controlled by accurate regulation of the temperature of the bath, the rate of firing, and the amount, method, and type of flux used.
APTIC-24116

### RECOVERY OF BY-PRODUCT FLOUORINE.

Ind. Eng. Chem., 50 (10):1525-1528, Oct. 1958. 14 refs. (Presented at the American Chemical Society, 132nd Meeting, Symposium on Fluorine Chemistry, New York, Sept. 1957.)
Grady Tarbutton, Thad. D. Farr, Thomas M. Jones, and Harry T. Lewis Jr.
Identifiers: *Fertilizer manufacturing, *By-product recovery, *Fluorine compounds, *Phosphates, Fertilizing, Absorption, Ammonium compounds, Fluorides, Aluminum compounds, Sodium compounds.

Basic information was obtained for developing practical methods for recovering fluorine compounds from effluent gases from phosphate processes and converting this fluorine into useful end products. The study included experiments with gases discharged from kilns for nodulizing rock phosphate and from a demonstration furnace for the manufacture of calcium metaphosphate fertilizer. On the assumption that the fluorine in nodulizing kiln gas was present only as hydrogen fluoride, initial work on recovery of fluorine from dilute gases was directed toward a solid-bed system for absorbing the fluorine. In a quantitative test, two absorption beds of porous sodium fluoride were connected in series --the first, in a copper tube at 300 C, for absorption of sulfur trioxide, and the second, in a silver tube at 100 C, for absorption of the hydrogen fluoride liberated from the first. Later it was found that much of the fluorine was present as silicon tetrafluoride, and emphasis was shifted to other methods of recovery. A method partially developed by TVA for preparing aluminum fluoride from ammonium fluoride solutions containing phosphoric acid involves precipitation of ammonium hexafluoroaluminate, which is then decomposed by heat to leave a residue of aluminum fluoride; the volatilized ammonia and ammonium bifluoride are recycled. An alkaline and an acid method for preparing cryolite were also evaluated. In the alkaline method, solutions of the reactants are heated to boiling and mixed, and the hot basic solution is acidified to the phenolphthalein end point by slowly adding carbon dioxide. In the acid method, a slightly acidic solution of ammonium fluoride is mixed with a solution of sodium and aluminum salts without heating.
APTIC-24117

### FUEL OIL DESULPHURIZATION.

Chem. Process Eng., 51 (8):5, Aug. 1970.
Personal Author Not Recorded.
Identifiers: *Fuel oil preparation, *Alkaline additives, Limestone, Fuel oils, Desulfurization of fuels, Calcium compounds, Vanadium compounds, Oxides, Sulfur compounds.

Commercial development work has begun on a process in which sulfur is removed from fuel oil in a chemically-active fluidized bed gasifier. After air is blown into the bed, which consists of lime, and the fuel oil injected, a complicated series of reactions occur that result in the sulfur in the oil becoming fixed on the lime bed as calcium sulfide. The sulfur-free gas is passed to a burner where it is completely burned with additional air. The calcium sulfide is almost completely converted back to the original lime. The process will remove almost 100% of the sulfur in the fuel even from fuels containing 4% sulfur. Under certain conditions, it is also possible to remove 100% of the vanadium compounds which can cause high-temperature corrosion. Other advantages of the process are that only part of the combustion air passes through the gasifier and that the bed can be easily built integral with a boiler, positioned immediately before the combustion chamber.
APTIC-24137

### HEAD LOSS THROUGH AIR FILTERS OF FIBROUS MATERIALS AT HIGH VALUES OF REYNOLDS NUMBER.

(Perdita di carico nei filtri d'aria dei materiali fibrosi per valori elevati del numero di Reynolds). Text in Italian. Condizionamento Dell'aria Riscaldamento Refrigerazione (Air Conditioning Heating Cooling), 13 (3):116-120, March 1969. 13 refs.
Francesco Reale.
Identifiers: *Screen filters, *Design criteria, *Mathematical analyses, Italy, Air conditioning equipment, Ventilation, Fluid flow, Pressure.

Fiber mats constitute one of the most popular types of filter used in air conditioning and ventilating equipment. At the planning stage, an important parameter that needs to be known is that of the pressure drop across the filter, which in the present case is examined in terms of Reynolds numbers in the range 0.5-15. Two theoretical approaches are compared: that of elementary channels, and that of the friction of an individual fiber, after which a new approach is proposed, with a special validity for high Reynolds numbers (larger than 1). In this range, for a given density of fibers (which affects the average distance between fibers) the influence of the fibers upon each other becomes negligible. A simple experimental procedure is described for verifying the mathematical propositions presented.
APTIC-24141

### TVA RESEARCH ATTACKS WASTE RECOVERY, POLLUTION CONTROL.

Chem. Eng. News, 48 (44):89-90, Oct. 19, 1970.
Personal Author Not Recorded.
Identifiers: *Research programs, *Tva, *Fertilizing, Soils, Stack gases, Chemical processing, Electric power production, Fertilizer manufacturing, Solid waste disposal, By-product recovery, So2 removal (combustion products), Phosphoric acid, Sulfuric acid, Aluminum compounds, Phosphates.

Participants in the eighth biennial demonstration of fertilizer technology, held at the Tennessee Valley Authority's National Fertilizer Development Center, Muscle Shoals, Ala., were told of current environment related projects at the center. These projects include use of composted municipal waste as a soil conditioner, using by-products of phosphate rock processing in production of aluminum, and exploiting sulfur dioxide from power plant stack gases in production of sulfuric acid, phosphoric acid, and phosphatic fertilizers. TVA also has research under way in six closed watersheds in Alabama, Tennessee, and North Carolina in an effort to determine to what extent nutrients from fertilizers are involved in eutrophication.
APTIC-24142

### CPI'S STAKE IN CLEAN CARS.

Chem. Eng., 77 (23):78-80, Oct. 19, 1970.
John C. Davis.
Identifiers: *Power sources, *Automobiles, *Automotive emission control, Electric propulsion, Fuel cells, Steam engines, Alcohols, Cooling, Thermodynamics.

Detroit automakers have concentrated their research efforts on developing scavengers and reactors to remove harmful emissions from the exhaust and vents, whereas others have been diverting their attention to alternatives such as electric and steamdriven cars. Current steam car prototypes can operate well below 0 F, run with smaller boilers that are hot-spot free, control performance easier, hold starting times below 30 sec, and achieve mileage economies of 25-30 mpg on kerosene. The three most popular classes of organic fluids being investigated are phenols, glycols, and coolants. Coolants include Du Pont's Freon, Dow Chemical's Dowtherm 209, Monsanto's Thiophene, and Lear's trifluoroethanol. An important thermodynamic property common to many organic fluids is a virtually vertical saturation line, which allows expansion to take place near saturation without fear of condensation and resultant cycle inefficiency. Superheat is held to a minimum, thereby reducing chances of thermal decomposition. Supporters of organic fluids say these will make possible the building of a lower cost engine that will run at a lower temperature than conventional steamers and obviate the need for expensive alloys. Steam supporters say that advocates of organic fluids have little chance of building a genuinely hermetically sealed vapor system, and that many organics are flammable or toxic and require a large boiler and condenser to deliver adequate power to the expander. Designers of external combustion engines almost always point to the boiler as the biggest headache, then the expander, boiler-feed pump, controls and condenser. The most popular and reliable battery used in electric cars continues to be the lead-acid cell, but it lacks the ability to supply enough power for long distances and then recharge quickly. Sodium-sulfur, lithium-chlorine, and zinc-air cells are also mentioned.
APTIC-24150

### A NEW METHOD OF TREATMENT OF SULFUR DIOXIDE ABSORBING SOLUTION.

(Aryusangasu kyushueki no shori hobo). Text in Japanese. (Steel Manufacturing Chemical Industries (Japan)), Japan. Pat. Sho 37-9451. 3p., July 27, 1962. (Appl. Sept. 3, 1960, claims not given).
Seiichiro Maeda, Hiromi Hasegawa, and Hiroya Watanabe.
Identifiers: *Corrosion, *Chemical processing, *Absorption (general), Japan, Primary metallurgical processing, By-product recovery, Sulfuric acid, Ammonium compounds, Sulfates.

The dilute sulfur dioxide discharged from sulfuric acid plants or ore refineries is removed by absorption in ammonium sulfite solution. The concentrated solution of sulfur dioxide thus formed is added to sulfuric acid and regenerated. In this process of recovering sulfur dioxide, ammonium sulfate is also recovered. Normally, minute amounts of ammonium thiosulfate and ammonium polythionite are contained in the solution, causing corrosion of the container. The present invention is concerned with abating the corrosion. After establishing that corrosion was primarily caused by the two ammonium salts, it was found that the rate of decomposition of the salts was a function of acid concentration, temperature, and time. The decomposition is a one-molecular reaction that decreases corrosion when these three factors are satisfied. Container corrosion was almost

completely negligible when an ammonium sulfite-SO2 solution was heated with excess sulfuric acid, so the potassium dichromate consumption was below 0.002 mol/l. In a sulfuric acid manufacturing factory, the sulfur dioxide absorbing solution contained 7-9% ammonia and 25-33% free sulfuric acid. The result of a corrosion test showed 10-15 g/sq m/nr. When the solution was kept at 90 C for 3 hours and at an acid concentration of 10 N, ammonium thiosulfate and ammonium polythionite were reduced below 0.0004 mol/l in terms of potassium dichromate consumption. As a result, corrosion was reduced to 1.2-1.5 g/sq m/nr, which was negligible.
APTIC-24160

### PROFITABLE POLLUTION CONTROL.

Mod. Metals, 26 (5):62, June 1970.
R. J. Yunghahn.
Identifiers: *Solvents, *Metal fabricating and finishing, *Heat transfer, Stack gases, Fumes, Surface coating operations.

Solvent fumes at a coil coating plant serve as fuel, eliminating air pollution and saving natural gas. A Caliqua heat exchanger in the exhaust gas stream of the incinerator reclaims about 43 million Btu/hr as it reduces stack gas temperatures from about 1085 F to 475 F. Reclaimed heat is distributed through a high pressure, high temperature water closed heat transfer system to the metal preparation unit, to the building make-up system, and to the process oven firing system.
APTIC-24163

### C-E'S AIR POLLUTION CONTROL SYSTEM.

Nat. Eng., 74 (7):8-10, July 1970. 7 refs. (Presented at the Industrial Coal Conference, Lexington, Ky., April 8-9, 1970.)
J. R. Martin, W. C. Taylor, and A. L. Plumley.
Identifiers: *Electric power production, *Control equipment, *Design criteria, Combustion gases, Sludge, Scrubbers, By-product recovery, So2 removal (combustion products).

Construction was recently completed of a laboratory facility for testing Combustion Engineering's air pollution control system. Principal components of the system are a wet scrubber, heat extractor, reheater, demister, clarifier or retention tank, slurry or mixing tank, additive and fly ash injector system, wet grinder, and vacuum filter. Piping and pumps are arranged to allow the system to operate in several different modes. Test work currently underway is directed toward resolving remaining problems on demonstration units installed in power plants. Future work will focus on industrial applications, design criteria for future systems, and by-product utilization of sludge.
APTIC-24168

### URILIZATION OF THE WASTE GASES FROM CLOSED FERROALLOY FURNACES.

Steel (USSR) (English translation from Russian of: Stal'), no. 1:38, 1970.
L. G. Salamatov.
Identifiers: *Primary metallurgical processing, *By-product recovery, *Fuels, Iron, Manganese, Ussr, Stack gases, Furnaces, Sintering.

Reference is made to a technique by which waste gases from ferroalloy furnaces for reducing, dephosphorizing, and sintering manganese ores can be used as a source of high-calorific fuels or raw materials for chemical synthesis. However, these toxic and volatile gases will require special safety measures, and the problem of sealing charging installations of ferroalloy furnaces is not yet fully solved.
APTIC-24169

## 3. MEASUREMENT METHODS

### EFFECTS OF FLUORINE. RESULTS OF INVESTIGATIONS WITH PLANTS AND ANIMALS.

(Bestimmung von Fluor in pflanzlichen, tierischen und anorganischen Substanzen, sowie in Waessern und Luft.) Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, Contract No. CPA 22-69-30, Project No. C 2439, 31p., 1968. 41 refs.
W. Oelschlaeger, and W. Woehlbier.
Identifiers: *Fluorine, *Chemical methods, *Animals, *Plants, *Foods, Milk, Plants (botany), Grasses, Leaves, Vegetables, Urinalysis, Bricks, Glass, Quartz, Coal, Colorimetry, Photometric methods, Sampling methods, Sulfuric acid, Fluorine compounds, Gases.

In the method for determining fluorine which like most others is based on distillation according to Willard and Winter, all error sources have been eliminated which may exist during sampling, grinding, ashing, treatment of the ash, distillation, and concentration of the distillate. Furthermore, almost F-free calcium oxide has been prepared which must be added prior to ashing to a number of samples of animal origin. For the determination of fluorine, distilling equipment was used which operates automatically to a large extent, is easy to handle, and was developed in cooperation with the aluminum plant Rheinfelden. The apparatus for concentrating distillates with very low fluorine contents works almost automatically. The method was tested with various synthetic solutions as well as with a number of internationally conducted ring analyses over several years. Today the method together with the equipment is used in many laboratories both in this country and abroad for the determination of fluorine in organic, inorganic and other materials.
APTIC-18264

### METHODS FOR AUTOMATIC CONTINUOUS MEASUREMENT OF POLLUTANTS IN AIR.

(Taiki osen no jido renzoku sokuteiho.) Text in Japanese. Kuki Seijo (Clean Air - J. Japan. Air Cleaning Assoc., Tokyo), 6 (3):41-48, Aug. 1968.
Saburo Yanagisawa.
Identifiers: *Automatic methods, *Continuous monitoring, Asia, Japan, Measurement methods, Monitoring.

Apparatuses for the automatic continuous measurement of air pollutants are described. Each apparatus has the following attributes: 1) A conductivity measurement recorder for recording the difference in conductivity before and after absorption. By this mechanism, feed gases are contacted with a liquid absorbent to produce a conductive ion. 2) A coulometric titration recorder for H2S and C12 measurements. Through the reaction of H2S and Br2, the concentration of H2S is recorded by measuring the electric current which is linear to the amount of Br2 reacted. 3) A recorder for the photoelectrical measurement of the color change of the absorbing liquid. 4) A filter paper-photo cell method for the photoelectrical measurement of the color change of the filter. 5) Nondispersed infrared absorption in which the infrared absorption spectra of each molecule is measured. 6) Ultraviolet absorption measurement of organic and inorganic gas. 7) Ionization by hydrogen flame for measuring as current the ion produced by an organic compound in the hydrogen flame. 8) Particulate-counting by scattered ray emission spectrometry. 9) An analyzing recorder for measuring continuous emissivity. Polluted air is introduced into the electric discharging poles and the emissive light of Be at 3130 A is recorded photoelectrically.
APTIC-18275

### DETERMINATION OF SIZE DISTRIBUTION AND NUMBER CONCENTRATION OF SMALL AEROSOL PARTICLES BY LIGHT-SCATTERING MEASUREMENT.

(Kosanranho ni yoru bisho earoru ryushi no sokutei.) Text in Japanese. Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 6 (2):63-69, June 1968. 49 refs.
Kanji Takahashi.
Identifiers: *Aerosols, *Particle size, *Light scattering, Asia, Japan, Particulates, Measurement methods, Particulate classifiers.

Light scattering by aerosol particles and its applications to the determination of size distribution and number concentration of small aerosol particles (0.05 to 0.6 microns) are reviewed. Figures illustrating polarization ratio, dissymmetry factor, and light scattering cross section of polydisperse small aerosol particles are given. (Author abstract modified)
APTIC-18281

### A BASIS FOR DETERMINING THE AMOUNTS OF UNBURNED GASES REMAINING IN INTERNAL COMBUSTION ENGINES AFTER COMBUSTION BY MEANS OF CONTINUOUS WASTE-GAS ANALYSES.

For primary bibliographic entry see Field 06.
APTIC-18282

### SYNERGISM BETWEEN FLUORINE EMISSION AND OTHER AIR POLLUTANTS.

(Ueber den Synergismus von Fluorimmissionen mit anderen Verunreinigungen der Luft.) Text in German. Staedtehygiene (Uelzen/Hamburg), 20 (4):82-85, April 1969. 11 refs.
Ernst Kahlert, and Willi Schneider.
Identifiers: *Phototoxicants, *Fluorine compounds, *Ph, Plant damage, Synergism, Germany, Pollutants, Phytotoxicants.

Previous measurements of fluorine emissions in various locations at Duisberg had indicated that there was little correlation between fluorine concentrations and extent of plant damage. A new series of measurements at three locations conducted over a series of four years indicated that while the total fluorine emissions were at no time excessively high, the amount of plant damage varied with the percentage of soluble fluorine salts. The relative proportion of soluble salts in turn was a function of the pH, the lower the pH the higher the percentage of soluble salts. It is concluded that only the soluble fluorides are phytotoxic and hence that the total fluorine level is not a proper basis for forecasting potential plant damage.
APTIC-18283

### DETERMINATION OF PARTICLE SIZE DISTRIBUTION OF SELECTED AEROSOL COSMETICS. I. HAIR SPRAYS.

J. Soc. Cosmetic Chemists, 20 (6):385-394, May 1969. 11 refs.
John J. Sciarra, Patricia McGinley, and Louis Izzo.
Identifiers: *Aerosols, *Analytical methods, *Particle size, Toxicity, Pollutants, Particulates, Spectrophotometry, Particulate classifiers, Samplers.

A method for determining the particle-size distribution of aerosols is discussed. The Cascade Impactor was used for this study. This instrument is able to collect and classify particles between 0.5 and 32 microns. The particles are sprayed into a chamber and carried with an air stream through a series of small jets, each succeeding jet opening being of a smaller diameter than the previous one. The larger particles are deposited on the upper slides. As the jet openings become smaller, the air stream velocity is increased, giving the smaller particles sufficient momemtum to impact the lower slides. In this study, the aerosol was hair spray. The data obtained can be an indication of the relative toxicity of the product based on the proportion of particles below 10 microns. It is these particles which will become airborne and subject to inhalation.
APTIC-18284

### PARTICLE SIZE DETERMINATION.

(Puntai no ryuhdo sokutei.) Text in Japanese.
Kuki Seijo (Clean Air - J. Japan Air Cleaning Assoc., Tokyo), 6 (6):18-25, 1969. 5 refs.
S. Miwa.
Identifiers: *Particle size, Japan, Measurement methods, Particle counters, Particulate classifiers, Particle shape, Microscopy.

Reliability and limitations of existing methods of particle size determination are critically reviewed. Recent trends in measuring techniques emphasize a close examination of the measuring conditions, development of rapid measuring instruments, and interpretation of the numerical value obtained. The importance of primitive methods of particle size determination by sight and touch is stressed. Size determination by the optical microscope has the advantage of being a direct observation but also has a disadvantage due to the irregular shape of particles. Particles of Al2O3, SiC, silica sand, and glass sphere, prepared between 710 and 590 microns by standard screens, were subjected to size determination by weight measurement, optical microscope, Zeiss particle counter, and free fall velocity through sugar solution. The latter gave an arithmetic mean of the screen meshes. The pipet and pycnometer methods are widely used for particle size determination, but they require skillful manipulations. It is concluded that basic understanding of particle size determination is more important than particulars of the measuring techniques.
APTIC-18286

### ELECTROCHEMICAL CONCENTRATION CELLS FOR GAS ANALYSIS.

For primary bibliographic entry see Field 06.
APTIC-18292

### AIR POLLUTION AND DISTRICT HEATING.

For primary bibliographic entry see Field 01.
APTIC-18295

### HEAVY METALS WITHIN THE REGION OF NORRKOPING.

(Tungmetall-fororeningar inom Norrkopingsomradet.) Text in Swedish. Lund Univ. (Sweden), Institution for Ecological Botany, 12p., 1969.
C. Tyler.
Identifiers: *Measurement methods, *Air quality measurements, *Industrial emission sources, *Sweden, Plant indicators, Sampling methods, Cadmium compounds, Chromium compounds, Cobalt compounds, Copper compounds, Lead compounds, Nickel compounds, Zinc compounds.

Measurements have been made in the town of Norrkoping, Sweden with about 90,000 inhabitants of heavy metals such as lead, cadmium, cobalt, copper, chromium, nickel and zinc. In 59 sites, at least 50 meters from any road, three samples were taken at each site. The metals were analyzed in common mosses, Hypnum cupressiforme. The maximum values were lead: 286 ppm, cadmium: 4.9 ppm, cobalt: 41 ppm, copper: 265 ppm, chromium: 36 ppm, nickel: 38 ppm and zinc: 530 ppm. The high precipitation of cobalt, copper, cadmium, and zinc can probably be explained by emissions from an industry just outside the town.
APTIC-18297

### THE CONTAMINATION OF PRECIPITATION IN THE UPPSALA REGION DURING JULY OCTOBER 1962.

(Nederbordens halt av fororeningar i och omkring Uppsala under juli - oktober 1962.) Text in Swedish. Meteorologiska institutionen, Uppsala universitet, Serien Rapporter No. 8, 23p., 1968. 8 refs.
T. Andersson.
Identifiers: *Rain, *Chemical methods, *Air quality measurements, *Sweden, Electricity (atmospheric), Acids, Chlorine, Calcium compounds, Potassium compounds, Sodium compounds, Sulfur compounds.

During July-October, 1962 a network of 24 stations in an area of about 400 km2 surrounding Uppsala collected monthly rainfall samples for chemical analysis. Analyses were performed for the following quantities: acidity, electrical conductivity, chlorine, sodium, potassium, calcium and sulphur. Much higher values were obtained in the town area than in the surrounding rural area, but not for pH that showed lower values in the town area. The geographical distributions and deposits of the measured quantities are shown. The town maximum is evident for Ce, K, Ca and S. The toiwn maximum is explained by a wash-out in the subcloud layer.
APTIC-18298

### METHODS OF SAMPLING AND ANALYZING HEALTH-HAZARDOUS SILICA DUST.

(Provtagnings- och analysforfaranden for silikosfarligt damm.) Text in Swedish. Arbetsmedicinska Institutet, Stockholm, Sweden, AI-rapport No. 3, p. 8-39, 1968.
Harry Ohman.
Identifiers: *Silicates, *Dusts, *Sampling methods, *Sweden, Quartz, Air quality measurements, Particle size, Particulate sampling, Impingers, Membrane filters, Ethyl alcohol.

The methods for sampling and analyzing air-borne free-silica dust which are in use and recommended by the Swedish Institute of Occupational Health are described in detail. The impinger method with some modifications and a filter method (membrane) for determination of total dust concentration by weight in air are described. The particle fraction below 5 microns in the dust was determined by weight after sedimentation in ethyl alcohol and the method applied for the analysis of quartz, cristobalite and tridymite in this respirable fraction of the dust was X-ray diffraction.
APTIC-18300

### DETERMINATION OF SILICA AND L-HYDROXYPROLINE IN SMALL TISSUE SAMPLES.

Studia Laboris et Salutis, No. 2, p. 3-12, 1969. 5 refs. Translated from Swedish.
A. Swensson, and U. Ulfvarson.
Identifiers: *Silicon compounds, *Tissues, *Chemical methods, Mineral products, Colorimetry.

Methods for determination of SiO2 and L-hydroxyproline in tissue samples, used in experiments on the fibrogenetic power of different mineral particles, are presented in some detail. The method for determination of SiO2 is based on an earlier colorimetric method which utilizes the blue colored complex which is formed by the reduction of the yellow silico molybdic acid complex. The coefficient of variation averaged 4.7 per cent for determination of 2.5 - 30 mg silica. A method for determination of L-hydroxyproline has been developed by Newman and Logan 1950, later modified by Martin and Axelrod 1953. The method described is based on these and utilizes the red colored complex formed between oxidized hydroxyproline and p-dimethyl amino benzaldehyde. The coefficient of variation averaged 5.6 per cent for the determination of L-hydroxyproline between 3.5 and 9.6 mg. (NSNCO abstract)
APTIC-18303

### DETERMINATION OF NITROUS GASES IN AIR.

(Bestamning av nitrosa gaser i luft.) Text in Swedish. Arbetsmedicinska Institutet, Stockholm, Sweden, AI-rapport No. 11, 112p., 1969. 61 refs.
Ingvar Skare.
Identifiers: *Nitrites, *Gas sampling, *Nitrogen oxides, Sweden, Air quality measurements, Chemical composition, Absorption, Nitrogen dioxide (no2), Ozone, Oxidation.

In order to determine NO2 in air, absorption has been studied firstly in an alkaline water solution, secondly in an acid reagent solution (Salzman reagent). In the case of alkaline absorption, the absorption efficiency and the internal relation between the amount of nitrite and nitrite ions in the solution was shown to depend on the original NO2 concentration of the gas sample within certain limits. A suggested explanation of these phenomena has been given. Absorption of NO2 in acid reagent solution produced a higher absorption efficiency, higher sensitivity, no carbon dioxide uptake, and a molar equivalence between the absorbed quantity of NO2 and the calibrated quantity of nitrite ions, at least for samples with a NO2 concentration of less than 100 ppm. The recommendation is that when analyzing samples with a NO2 concentration greater than 100 ppm the use of an evacuated bottle charged with alkaline solution is recommended. When analyzing samples with a NO2 concentration of between 1-100 ppm it is recommended to use an acid reagent solution in an evacuated bottle and analyzing of NO2 concentration less than 1 ppm should be carried out by absorption in an acid reagent solution charged in a fritted bubbler. When determining the local concentration of NO + NO2 in air, investigation has been mainly concentrated on the total oxidation methodology. The most suitable oxidation agents proved to be ozone or hydrogen peroxide. When analyzing a sample with a total concentration of NO + NO2 greater than 10 ppm the use of an evacuated bottle charged with an alkaline hydrogen peroxide solution is recommended.
APTIC-18304

### THE RESULT OF OBSERVATION ON PLUME RISE.

For primary bibliographic entry see Field 05.
APTIC-18307

### SURFACE COLLECTION EFFICIENCY OF LARGE-PORE MEMBRANE FILTERS.

Health Phys., vol. 10:495-499, 1964. 5 refs.
C. L. Lindeken, F. K. Petrock, W. A. Phillips, and R. D. Taylor.
Identifiers: *Isotopes, *Alpha particles, *Membrane filters, Continous monitoring, Filters, Experimental equipment, Plutonium compounds.

A solid-state, continuous, plutonium-alpha air monitor required a filter with high surface-collection efficiency to permit the detector to resolve between the alpha energy of plutonium-239 and that of the natural alpha background. Because the resistance of submicron membrane filters to air flow was too high for constant-flow sampling rates to be maintained, the surface-collection efficiency of large-pore membrane filters was investigated. Membrane filters with pore diameters from 0.5 to 10 microns were evaluated by collecting the airborne radon daughter products on a filter and measuring the energy resolutions at the 7.68 MeV RaC' activity. Compared with the submicron filters, the large-pore membrane filters showed no serious sacrifices in collection efficiency until the pore diameters exceeded 5 microns. Since these filters provide greater air flow at a given pressure differential than submicron filters, they appear suitable for sampling airborne alpha-emitting radioisotopes.
APTIC-22169

### PROGRESS IN ATMOSPHERIC-AEROSOL RESEARCH AT THE UNIVERSITY OF WASHINGTON.

Trend Eng. Univ. Wash., 21 (2):19-21, 27, April 1969. 10 refs.
Robert J. Charlson.
Identifiers: *Aerosols, *Turbidimetry, Research programs, Visibility, Haze, Light scattering.

Atmospheric aerosols--particles suspended in air--are a subject of research overlapping the air resources and geophysics fields, and studies of visibility reduction in polluted air are discussed here. For this purpose an integrating nephelometer with wavelength resolution was developed and applied to the monitoring of light scattering as a func-

tion of time, measurements of smoke dispersion, the monitoring of aerosol background of air from urban and uninhabitated areas, and studies of the wavelength dependence of the light-scattering coefficient. Preliminary data from the wavelength dependence studies are presented, indicating that the wavelength dependence of atmospheric haze is proportional to a negative exponent of about .8. Related investigations now in progress concern means of measuring the size distribution of atmospheric aerosols and the comparison of backscatter via optical radar.
APTIC-22176

### DUST MEASUREMENT AND STANDARDS.

Trans. Natl. Safety Congr., 53rd, vol. 7:18-26,
1965. (Presented at the Natl. Safety Congr., 53rd,
Coal Mining Sessions, 1965.)
Earle P. Shoub.
Identifiers: *Air quality standards, *Dusts, *Samplers, Occupational health, Lungs, Pneumoconiosis, Coal, Mining, Particle size, Impingers, Membrane filters.

Interest in chest diseases traceable to inhaled dusts has grown among members of the coal mining industry. It is reported that 10% of the currently employed miners have pneumoconiosis and that 20% of the men formerly employed in the mines are stricken. A comparison of the standards of acceptable coal dust exposure from several countries shows that there is little agreement among them when taken collectively. They differ on particle size, range, what is meant by particle size, on method of collection, determination of concentration, and the importance of composition. One method of determining particle size is to relate the performance of a suspended particle to the size of a sphere of unit density which would behave identically if suspended in air. This method can be called size equivalent to unit density spheres and is a way of expressing the aerodynamic qualities of dust. This is the preferred method of determining particle size since the respiratory system generally conforms to the laws of aerodynamics. There are several devices for counting particles including the thermal precipitator, midget impinger, and membrane filter. The Bureau of Mines and the Public Health Service will conduct a study of the medical and environmental aspects of chest diseases in coal miners, and it is recommended that this study be concerned with only hygienically significant dust in the breathing zone and the work area. The survey should separately identify the dust exposure of different mining operations and make a compositional analysis of silica and ash.
APTIC-22177

### COMPARISON OF FILTER MEDIA AGAINST LIQUID AND SOLID AEROSOLS.

Los Alamos Scientific Lab., N. Mex., Contract W-
7405-ENG. 36, Rept. LA-4345, 8p., May 1970. 29
refs.
Ronald G. Stafford, and Harry J. Ettinger.
Identifiers: *Aerosols, *Membrane filters, Experimental equipment, Particle growth, Liquids, Solids, Electric charge.

Several filter media were evaluated using liquid (dioctyl phthalate) and solid (polystyrene latex) test aerosols. Data were obtained for each medium at velocities ranging from 4 to 190 ft/min. Below 100 ft/min, Whatman-41 filter paper has a significantly higher efficiency when tested with solid aerosols. Below 40 ft/min, IPC-1478 also has a significantly higher efficiency when tested with solid aerosols. Instrumentation limitations prevented measuring any significant differences for the high-efficiency media tested. Aerosol agglomeration and charge effects were eliminated by using an impactor and by establishing charge equilibrium for the solid aerosols. Average electron charge on latex particles was reduced to 0.5, and the test aerosol consisted of 87 to 97% single particles. Effects of filter loading on efficiency and pressure drop were also measured. Whatman-41 efficiency is significantly increased due to loading with polystyrene latex aerosols. (Author abstract modified)
APTIC-22189

### EFFICIENCY OF IPC-1478 FILTER PAPER AGAINST POLYSTYRENE LATEX AND DIOCTYL PHTHALATE AEROSOLS.

Los Alamos Scientific Lab., N. Mex., Contract W-
7405-ENG. 36, Rept. LA-4356, 11p., May 1970. 7
refs.
Ronald G. Stafford, and Harry J. Ettinger.
Identifiers: *Ipc-1478 filter paper, *Aerosols, *Membrane filters, Particle size, Experimental equipment, Liquids, Solids.

IPC-1478 filter paper efficiency was evaluated using polystyrene latex and dioctyl phthalate aerosols. Efficiency was measured as a function of particle size, filtration velocity, and filter mass loading. Experimental results for 0.557 micrometers and larger particle sizes indicate that this medium has limited effectiveness under high-velocity and high-loading conditions. Differences in efficiency were observed when this medium was tested with solid and liquid aerosols. (Author abstract modified)
APTIC-22190

### PHOTOCHEMICAL OXIDATION OF SULFUR DIOXIDE IN AIR.

For primary bibliographic entry see Field 05.
APTIC-22191

### OZONE GAS ANALYSIS BY POLYMER CHAIN SCISSION.

Angew. Makromol. Chem., 7 (83):101-109, 1969. 9
refs.
H. H. G. Jellinek, and A. Burkhardt.
Identifiers: *Synthetic rubber, *Measurement methods, *Ozone, Cracking.

A method for determining small amounts of ozone in air by chain scissioning of polymer films due to the high reactivity of ozone is described. The proposed method has a sensitivity limit for high molecular weight of polystyrene of 2 ppm of ozone in air. However, a butyl rubber has a lower sentivity limit of 0.02 ppm plus or minus 20% at 35 C and 24 hours reaction time. The latter can be decreased considerably if higher temperatures are used. Still lower sensitivity limits could be in principle attained with butyl rubber of longer chain length and higher isoprene content. Nitrogen dioxide and sulfur dioxide will not interfere at low concentrations of a few ppm. (Author abstract modified)
APTIC-22217

### AUTOMATIC ANALYSIS OF GASEOUS IMPURITIES IN THE ATMOSPHERE.

(Samocinne amaluzatory plynnych necistot v
ovzdusi). Ochrana Ovzdusi, 1969:129-135, Sept.
Translated from Czech. Belov and Associates,
Denver. Colo., 23p.
T. Bartovsky.
Identifiers: *Analytical methods, Czechoslovakia, Flame ionization detector, Automatic methods, Photometric methods, Instrumentation, Ammonia, Hydrocarbons, Carbon dioxide, Carbon monoxide. Nitrogen oxides, Sulfur dioxide, Hydrogen sulfur.

Tables are presented which show a summary of the current developments in automatic analyzing instruments used for concentrations of pollutants in the atmosphere or in industrial stack gases. The list of manufacturers is based on the principle on which the function of the instrument is based. Instruments based on absorption of infrared radiation can be used to measure carbon monoxide and dioxide, nitrogen oxides, ammonia, sulfur dioxide, hydrogen chloride, and hydrocarbons. For determining very low concentrations of compounds in gas mixtures, a combination of photometric analysis and the reaction of the gas and liquid is used. Instruments based on the electrolytic conductivity change of liquids after reaction with glass are also suitable for measuring low concentrations in gas mixtures. Depolarization and polarographic instruments use the electrochemical reaction on the polarized electrode immersed in the liquid. In coulometric instruments, the compounds are electrolytically oxidized with bromine or iodine. This method is used to measure SO2, hydrogen sulfide, mercaptans, thiophenes, thioethers, organic sulfides, and olefins. For measuring high concentrations, the election of instruments for each compound is broad and the selection of the most suitable instrument depends on other conditions, especially on the type of other impurities.
APTIC-22220

### INFRARED ANALYSIS OF SUSPENDED PARTICULATES WITH MILLIPORE FILTERS AND ATTENUATED TOTAL REFLECTION.

Anal. Chem., 36 (12): 2341-2344, Nov. 1964. 2 refs.
Robert W. Hannah, and James L. Dwyer.
Identifiers: *Attenuated total reflection, *Suspended particulates, *Spectrophotometry, *Membrane filters, Particle size, Infrared radiation.

Attenuated total reflection (ATR) has been characterized as being essentially a surface effect. One implication of this is that for a given analysis only a fraction of a milligram of material properly presented to the totally reflecting face is required to produce a good spectrum. Membrane filters, because of their surface retention ability, not only accomplish a separation of particulate material from fluid media but also permit a nearly ideal presentation of the sample to the ATR crystal. In addition, substrate interferences which complicate transmission results, are reduced considerably. This method is especially valuable where the material to be examined is present in very low concentrations normally difficult to isolate from the fluid media or of a microscopic particle size. Several diverse examples are described which illustrate the utility of the technique. Infrared spectra were obtained with a Perkin-Elmer Model 521 spectrophotometer equipped with the single and triple-reflection ATR accessories. Applications include: powders dispersed in liquid vehicles (paint analysis, writing ink, and cream); colloidal trace contaminants present in liquids (beer, stream water, tea); aerosols, mists, and fumes (exhaust from two-cycle and four-cycle engines); biochemical (microorganism metabolism). (Author Abstract)
APTIC-22244

### THE AEROSOL EFFICIENCY AND PRESSURE DROP OF A FIBROUS FILTER AT REDUCED PRESSURES.

J. Colloid Sci., vol. 15:546-562, 1960. 24 refs.
S. C. Stern, H. W. Zeller, and A. I. Schekman.
Identifiers: *Fibrous filter, *Aerosols, *Pressure, Particle size, Membrane filters, Design criteria, Mathematical analyses, Upper atmosphere, Diffusion, Flow rates, Permeability.

The collection efficiency of an Institute of Paper Chemistry fibrous filter for monodispersed aerosols of 0.026-1.71 micron diameter and the resistance to flow through the filter are investigated experimentally at reduced pressures which simulate air densities in the stratosphere. Single fiber efficiencies in the diffusion and impaction regimes were calculated and compared with theory. Resistance to flow through the mat was analyzed in terms of a drag coefficient of a single fiber imbedded in a mat or flow through a bed composed of capillary tubes. Results show the dominant effects of slip flow in increasing collection efficiency and reducing pressure drop through the filter at reduced pressures. (Author abstract modified)
APTIC-22245

### EXPERIMENTAL STUDIES OF INTERNAL COMBUSTION AUTOMOTIVE MOTORS WITH CONTROLLED IGNITION.

(Indagini sperimentali sulle emissioni dei motori a c.i. ad accensione comandata per autoveicoli).
Text in Italian. Termotecnica (Milan), 22 (1):29-40, 1968. 20 refs. (Presented at the Associazione Termotecnica Italiana, 22nd National Congress, Rome, Sept. 27-29, 1967.)
Giuseppe Gabola, and Massimo Feola.
Identifiers: *Engine exhausts, *Internal combustion engines, *Analytical methods, Italy, Vehicles, Instrumentation, Laboratory facilities, Infrared radiation.

The study described seeks to confirm the results of extensive tests made in Los Angeles by Coordinating Fuel and Equipment Research on 169 vehicles of various makes. The authors tested cars of the following makes: Alfa Romeo, Petter, and Lancia, using mostly laboratory tests, under controlled atmospheric conditions, utilizing either a roller bank or direct connection of the motor with a resistance analogous to that encountered by a vehicle on the road, plus a flywheel with an inertia analogous to that of road conditions. Exhaust gases were measured with transducers connected electrically to recording instruments. Infrared devices were found effective in making rapid determination of the content of exhaust gases sampled. A complete cycle was devised to simulate actual operation, including idling, acceleration, cruising speed, and deceleration.
APTIC-22250

### NOMOGRAMS FOR THE DETERMINATION OF THE AIR EXCESS COEFFICIENT AND THE DOSAGE, AS A FUNCTION OF FLUE GAS COMPOSITION OBTAINED WITH CHEMICAL ANALYZERS.

(Nomograme pentru determinarea coeficientului de exces de aer si a dozajului, in functie de compozitia gazelor arse obtinuta cu analizoare chimice). Text in Romanian. Bul. Inst. Petrol, Gaze Geol., vol. 15:243-251, 1967.
E. Wasserstrom, and C. Pirvulescu.
Identifiers: *Nomograms, *Stack gases, *Excess air, Operating criteria, Europe, Fuel oils, Furnaces, Mathematical analyses, Hydrocarbons, Carbon monoxide.

A mathematical procedure is described for drawing nomograms that express the relationship of the air excess coefficient and air supply to the dry flue gas composition, which can be determined by means of chemical analyzers. It is assumed that petroleum fuels are being burned, that these are mixtures of hydrocarbons, and that carbon monoxide is the only product of incomplete oxidation.
APTIC-22251

### COLLECTION EFFICIENCY OF WHATMAN 41 FILTER PAPER FOR SUBMICRON AEROSOLS.

Health Phys., vol. 9:305-308, 1963. 4 refs.
C. L. Lindeken, R. L. Morgin, and K. F. Petrock.
Identifiers: *Whatman-41 filter paper, *Velocity, *Aerosols, Particle size, Membrane filters, Experimental equipment.

The collection efficiency of Whatman 41 filter paper was determined using submicron test aerosols of monodispersed polystyrene latex. Measurements were made over a velocity range of 12-195 f.p.m., using aerosols with diameters of 0.088, 0.188, 0.264, 0.365 and 0.557 microns. For sizes less than 0.557 microns well-developed efficiency minima occur in the velocity range of 20-30 f.p.m. In no case was the efficiency found to be below 70 per cent. At 195 f.p.m. the efficiency is essentially size-independent. (Author abstract modified)
APTIC-22253

### THE EFFECTIVENESS OF DEPOSITING AEROSOL PARTICLES ON A PLANE BACKING.

Probl. Fiz. Atm., no. 5. 1967. 8 refs. Translated from Russian. Aztec School of Languages, Inc., McLean, Va., Research Translation Div., p. 247-255, June 1970. CFSTI: NASA TT F-587
L. S. Ivlev.
Identifiers: *Deposition, *Particulates, *Cascade samplers, *Impingers, Ussr, Aerosols, Particle size, Collectors, Mathematical analyses.

The design of inertial collectors for finely divided aerosols requires an examination of the effectiveness of depositing particles from an air current onto a backing. The present investigation studied aerosol deposition at currents of 4, 20, and 200 m/sec in cascade and simple impactors with pure glass plates and plates treated with silicone. Distribution of the particles on the plates varied according to size, and there appeared to be incomplete deposition of particles from 0.3 to 1.6 micron. The measurements obtained were not adequate for deriving a mathematical model of particle deposition. Representative measurements will be obtained only when impactor traps are standardized.
APTIC-22286

### STUDIES ON THE ANALYSIS OF CONTAMINATING SUBSTANCES IN THE ATMOSPHERE.

(Taiki osen busshitsu no bunseki ni kansuru kenkyu). In: Studies on the Measurements of Trace Metals in the Atmosphere. Emission Spectroscopic Analysis. (The Report of Inquiries and Studies on the Public Nuisance in the Commission of the Ministry of Welfare in 1966.) 19p., March 1967. 7 refs. Translated from Japanese. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 35p., Oct. 21, 1969.
Personal Author Not Recorded.
Identifiers: *Air quality measurements, *Spectrophotometry, *Trace analysis, Japan, Urban areas, Calibration methods, Research methodologies, Beryllium compounds, Chromium compounds, Iron compounds, Lead compounds, Manganese compounds, Nickel compounds, Vanadium compounds.

The results of an investigation of the quantity of metallic contaminants in ambient air are given. The analysis is conducted spectrophotometrically on samples from a high-volume sampler, taken at three locations over a six month period. The metals measured include vanadium, manganese, nickel, chromium, lead, iron, and beryllium. A detailed description of the methods used is provided, including luminous, spectral, and photometric conditions, and sample electrodes. The analytical accuracy and internal standards of the method are verified. A result of this study is the establishment of an analytical procedure for conducting quantitative investigations.
APTIC-22290

### PARTICLE SIZE DETERMINATIONS IN THE RANGE FROM 0.1 TO 10 MICRONS WITH A CENTRIFUGAL SEDIMENTATION BALANCE.

Staub (English translation from German of: Staub, Reinhaltung Luft), 30 (1): 1-8, Jan 1970. 9 refs.
CFSTI: TT 70-50047/1
Armin Buerkholz.
Identifiers: *Centrifugal separators, Germany, Particulates, Operating variables, Particle size, Design criteria, Experimental equipment.

Experiences gained from over 600 centrifugal sedimentations of several thousand different substances have shown that the sedimentation range, which for gravitational balances is restricted to 1-2 microns, can be continuously extended down to about 0.1 micron. The methods of sample preparation and of evaluation are identical in both cases. Since, however, the sedimentation occurs at an acceleration due to gravity increased 400 times, and since the height of fall is decreased to 2 cm, the time of analysis for the same viscosity is reduced by the factor of 4000. The instrument can also be used for differential measurements, so that the summation curve for the residual particle size distribution is directly recorded. The measuring method is discussed in detail and the results are reported. (Author abstract)
APTIC-22300

### INVESTIGATIONS WITH THE HORIZONTAL PLATE PRECIPITATOR.

Staub (English translation from German of: Staub, Reinhaltung Luft), 29 (12):35-42, Dec. 1969. 7 refs.
CFSTI: TT 69-55002/12
Heinrich Thuermer.
Identifiers: *Respiratory functions, *Dusts, *Horizontal plate precipitator, Lungs, Germany, Measurement methods, Design criteria, Mathematical analyses.

The assessment of hazards caused by fibrogenic dusts by means of gravimetric methods requires the determination of the fine-dust-lung-penetrating factor. For this purpose preliminary precipitators are used whose separation characteristics must correspond to that of the upper respiratory tract of humans. The separation function for an ideal and technically feasible design of a horizontal plate precipitator is developed and explained by an example. The total separation capacity is determined for dust of a particle size distribution occurring frequently. Comparison of different examples of the same type of apparatus shows that the measured fine dust component is a function of the plate distance distribution. In addition, it is shown that the error in dust measurements which occurs in the case of apparatus with a preliminary plate precipitator is significant, if the air flow rate is not adjusted accurately. The calculated result for the separation function is confirmed qualitatively. (Author abstract modified)
APTIC-22301

### TRACE ANALYSIS OF FIXED GASES BY GAS CHROMATOGRAPHY.

Am. Ind. Hyg. Assoc. J., vol. 25:359-368, July-Aug. 1964. 6 refs.
Sid Russell.
Identifiers: *Gas chromatography, *Trace analysis, Methanes, Hydrogen, Carbon monoxide, Nitrous oxide (n2o).

Chromatographic techniques utilizing an argon ionization detector with helium carrier gas are described for measuring trace amounts of carbon monoxide, hydrogen, methane, and nitrous oxide in one-milliliter air samples. Standing current resulting from impurities in the helium gas is substantially reduced by passing the helium first through a molecular sieve to remove moisture and then through another trap containing activated charcoal immersed in liquid nitrogen. Bleeding of contaminants from chromatographic columns and instrument surfaces is controlled by providing the column with the purified helium at 200 C and 10 psig. The detector is installed so that the complete flow from the column enters the anode, with tubes added to the purge port and normal outlet port to prevent back diffusion of gases. The sensitivity of the techniques are illustrated by a chromatogram showing close to full scale recorder pen deflections for fixed gases in concentrations of 100 ppm in a 0.[illegible]-milliliter air sample. A 2.0-milliliter air sample shows similar deflections for 2.5 ppm [illegible].
APTIC-22371

### MEASUREMENT AND BEHAVIOUR OF EXHAUST GAS IN POWER PLANT.

(Karyoku puranto haigasu no sokutei to kyodo). Hitachi Hyoron, 49 (11): 1138-1142, Nov. 1967. 19 refs. Translated from Japanese. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services. 23p., Oct. 29, 1969.
Kaoru Sakai, Fumio Mizuniwa, and Yasuji Hayashi.

Identifiers: *Stack gases, *Steam plants, *Measurement methods, Japan, Operating variables, Analytical methods, Gas sampling, Electrostatic precipitators, So2 removal (combustion products), Nitric oxide (no), Nitrogen dioxide (no2), Sulfur dioxide, Sulfur trioxide, Water, Reaction mechanisms.

In purifying exhaust gas in power plants, the development of desulfurizers and electric precipitators is being stimulated, but it requires a reliable method of analysis for gas ingredients. Mechanisms for the evolution of sulfur dioxide and sulfur trioxide are discussed. Volumetric methods for analysis of total sulfur, SO2 and SO3 include the neutralization process, the thorin process, and the arsenazo III process. Also discussed is the formation of nitrogen oxide and its measurement. Attempts to increase the reliability of methods for testing sulfur dioxide and trioxide, nitric oxide and nitrogen dioxide, and water are presented. The results of measurements in actual plants carried out according to the methods described or with a dew point indicator are summarized. Some observations on operating variables within the power plants are included. (Author abstract modified)
APTIC-22391

### THE MEASUREMENT OF DUST CONCENTRATIONS IN THE CHIMNEY INPUT GASES AT THE THERMAL POWER STATION OF CREIL (OISE).

(La Measure des concentrations en poussieres des gaz a l'entree des cheminees de la centrale thermique de Creil (Oise)). Genie Civil, p. 270-276, 1961 (°). Translated from French. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 29p., Oct. 31, 1969.
L. Edouard.
Identifiers: *Steam plants, *Stack sampling, *Control equipment, France, Stack gases, Dusts, Stacks, Sampling probes, Centrifugal separators, Electrostatic precipitators, Filters, Scrubbers, Flow rates.

Coal-burning electric power stations are equipped with dust removing devices to clean their effluent gases. The devices are usually of the electrostatic, scrubbing, or cyclone variety. A pollution control system at a particular power plant in France is described. A stack sampling procedure is presented to measure the quantity of dust remaining in the system after the control devices. Test equipment includes a probe, a filtering device, a gas-flow meter, and a vacuum pump. Various types of filters are described, noting the advantages and drawbacks of each. Determination of flow rate from inside and outside the flue is discussed.
APTIC-22401

### A NEW EXHAUST EMISSIONS ANALYZER FOR AUTOMOTIVE SERVICE APPLICATIONS.

Preprint, Society of Automotive Engineers, Inc., New York, 6p., 1970. 3 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 12-16, 1970, Paper 700100.)
James R. Hughes, and Ralph H. Torborg.
Identifiers: *Engine exhausts, *Analytical methods, *Carbon monoxide, Spark ignition engines, Carburetion, Hydrocarbons, Ultraviolet radiation.

An exhaust emissions analyzer, developed for use in the automotive dealership service environment, presents an accurate determination of the carbon monoxide concentration in the exhaust of any engine at a steady-state test condition. It also presents an indication of the unburned hydrocarbon concentration relative to 'normal' for any reciprocating spark ignition emission controlled engine at a steady-state curb idle test condition. Its utility as a field service tool is thus twofold: used as a diagnostic device, it enables a technician to decide if an engine has a carburetion problem or a malfunction in the combustion process; and used as an adjustment device, it aids in setting the proper carburetor idle mixture adjustment on emission controlled automotive engines. The device operates on an ultraviolet light sensing principle. (Author abstract modified)
APTIC-22446

### DIESEL EXHAUST HYDROCARBON MEASUREMENT- A FLAME-IONIZATION METHOD.

Preprint, Society of Automotive Engineers, New York, 9p., 1970. 3 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 12-16, 1970, Paper 700106.)
Karl J. Springer, and Harry E. Dietzmann.
Identifiers: *Engine exhausts, *Flame ionization detector, *Hydrocarbons, Diesel engines, Design criteria, Hydrogen, Oxygen, Temperature.

The design and development of an instrument for the measurement of total hydrocarbons in diesel exhaust is described, and its ability to measure steady-state and transient hydrocarbon emissions is indicated. The two-section system comprises a sampling train and flame-ionization detector and a chromatograph electrometer, recorder and backpressure regulator. A mixture of 40% hydrogen and 60% helium is the best fuel for low oxygen response with the system. The method has been used for more than a year in evaluating hydrocarbon emissions from a wide variety of diesel engines under a number of typical operating conditions. The greatest advantage of the high-temperature system is its potential for expressing the total hydrocarbon content in diesel exhaust. (Author abstract modified)
APTIC-22447

### EVALUATION OF VEHICLE EXHAUST GAS ODOR INTENSITY USING NATURAL DILUTION.

Preprint, Society of Automotive Engineers, Inc., New York, 10p., 1970. 9 refs. (Presented at the Automotive Engineering Congress, Detroit, Mich., Jan. 12-16, 1970, Paper 700105.)
Joseph M. Colucci, and Gerald J. Barnes.
Identifiers: *Engine exhausts, *Buses, *Odorimetry, Thresholds, Odors, Engine operating cycles, Diesel engines.

Although exhaust gas odorants are generally a product of engine and fuel parameters, it is the vehicle that the public associates with exhaust odor. The vehicle and its movements have a large influence on the dispersion of exhaust odorants and, therefore, on the actual public exposure to exhaust odor. A considerable amount of public exposure to vehicle exhaust odor results from municipal operation of diesel-powered buses, especially during the bus-stop sequence. Panel test procedures are developed for field evaluation of full-scale vehicle exhaust odor intensity during the idle and acceleration portions of a simulated bus-stop sequence. Odor tests, based on natural dilution of the vehicle exhaust to the odor threshold, are conducted in a controlled environment, indoors in large buildings. Different degrees of exhaust dilution are achieved by randomly varying the distance from the test vehicle to the panelists. Panelists are required to make yes-or-no decisions on whether or not they can detect an odor above the background level. Exhaust odor intensity is expressed in terms of the threshold response distance, with greater threshold response distances indicating greater exhaust odor intensity. The test procedures give adequate repeatability. Six repeat idle tests with one bus give threshold response distances ranging from 27-32 ft, averaging 29 ft. Four repeat acceleration tests with another bus gave threshold response distances ranging from 32-41 ft, averaging 36 ft. Idle tests with two different busses in two different test facilities show repeatable differences in the exhaust odor intensity, indicating that the procedure is capable of discriminating between two odor sources of differing intensity. (Author abstract modified)
APTIC-22448

### DESIGN OF A PROGRAMMER AND A PROPORTIONAL SAMPLING SYSTEM FOR AN ENGINE DYNAMOMETER.

Preprint, California State Dept. of Public Health, Los Angeles, 23p., 1960. 9 refs. (Presented at the Conference on Methods in Air Pollution Studies, 4th, Los Angeles, Calif., Dec. 5-6, 1960.)
John C. Chipman.
Identifiers: *Engine exhausts, *Gas sampling, *Dynamometers, Automatic methods, Aspirators, Design criteria, Instrumentation, Simulation, Irradiation chambers, Test engines.

The development is described of a system to automatically cycle a test engine on a modified engine dynamometer to produce an exhaust gas having a similar composition to that produced from a passenger vehicle when driven, in a normal manner, over a prescribed test route; and to transfer a controlled proportionate quantity of the exhaust emissions to an irradiation chamber. The dynamometer controls essentially consist of two synchronized cams which position the throttles of a test and slave engine to produce the desired load and speed variations of the test engine. The engine operating conditions designated as idle, acceleration, cruise and deceleration are simulated in this manner. The exhaust gas sampling technique is based on the venturi aspirator principle. The sampling rate is controlled by recirculating a portion of the chamber atmosphere through a venturi aspirator having its sidearm connected to the exhaust duct of the test engine. The sampling rate is regulated by controlling the rate of recirculated chamber gas passing through the throat of the venturi aspirator. The system will be used to provide representative exhaust samples for research on irradiated automobile exhaust gas mixtures as they interact with atmospheric conditions to produce smog. (Author summary modified)
APTIC-22453

### AUTOMOBILE EXHAUST ANALYSIS BY GAS CHROMATOGRAPHY.

Preprint, California State Dept. of Public Health, Los Angeles, 15p., 1960. 3 refs. (Presented at the Conference on Methods in Air Pollution Studies, 4th, Los Angeles, Calif., Dec. 5-6, 1960.)
Robert E. Neligan, Margaret F. Brunelle, and Daniel Saeli.
Identifiers: *Engine exhausts, *Gas chromatography, *Hydrocarbons, Sampling methods.

A procedure is outlined for the analysis by gas chromatography of automobile exhaust samples which results in the recovery of the C2-C10 hydrocarbons present in the sample. The method permits accurate measurements to be made both quantitatively and qualitatively in the ppm range on the C2-C6 fraction. Operating conditions, column selection, and suitable freeze-out techniques for such analysis are given in detail. The specified methods of sample preparation described are necessary because of the low concentration of hydrocarbons and the high concentration of oxygen, nitrogen, carbon dioxide, carbon monoxide, and water in the exhaust samples. Using the procedures and operating conditions as outlined, an exhaust gas sample will yield a chromatogram typical of those obtained from proportionate sampling devices which collect a composite exhaust sample of all driving cycles.
APTIC-22455

### DIFFERENTIAL CHARACTERIZATION OF OXYGEN AND OF NITROUS OXIDE BY A SIMPLE TECHNIQUE.

(Characterisation differentielle de l'oxygene et du protoxyde d'azote par une technique simple). Text in French. Bull. Acad. Nat. Med. (Paris), vol. 150:156-157, March 8, 1966. 1 ref.
Pierre Jolis, and M. Cara.
Identifiers: *Analytical methods, *Oxygen, *Nitrous oxide (n20), France, Nitrous oxide (n2o), Gases.

A certain number of fatal accidents have occurred, particularly, in hospital operating rooms, due to an

interchange of the oxygen and the nitrous oxide supplies. Although national and international regulations have considerably reduced the likelihood of such occurrences, the need remains to verify that the supplies are indeed correct. A simple, yet reliable method of carrying out this verification, requires merely an empty 1/2 liter glass jar and a box of matches. The jar is filled with the gas to be identified as one would do with a liquid (since both oxygen and nitrous oxide are heavier than air). The filling nozzle is withdrawn and the opening of the jar is shut with the palm of the hand and, perhaps, discarded if one suspects that it contains inflammable vapor (ether, for example). A burning match is thrown into the jar. Both nitrous oxide and oxygen make the flame grow bright with a brilliant flash (nitrous oxide is dissociated by the heat and yields the oxygen required for the combustion of the match. However, the oxygen combines with the hydrogen of the wood to yield water vapor which condenses in the form of fine droplets which render the glass of the jar translucent which looks whitish in back illumination. In the case of nitrous oxide, nitrous vapors are also formed almost immediately which are characterized by brownish color and odor
APTIC-22457

### AUTOMATIZATION OF CHEMICAL ANALYSES OF THE POLLUTION CONTROL LABORATORY.

(Automatisation des analyses chimiques du laboratoire de controle de pollution). Text in French. Technicon (France), Services Industriels, p. 3, 1970 (°).
D. Hertzog.
Identifiers: *Automatic methods, *Continuous monitoring, *Intermittent monitoring, France, Colorimetry, Aldehydes, Ammonia, Chlorides, Cyanides, Fluorine, Iodine, Nitrates, Nitrites, Oxygen, Phosphates, Sulfates.

An automatic analyzer, 'Auto Analyzer is described. The 'Auto Analyzer' can operate on a succession of samples or continuously and incorporates a peristaltic proportioning pump which allows the introduction of samples at a constant rate and their continuous mixing with the specific reagents required for the analysis. The samples are conveyed to different modules in which specific chemical operations are performed. Such as mixing of the reagents, continous filtration incubation, heat conditioning, distillation, extraction, and phase separation. The result of each reaction is measured by a differential colorimeter the readings of which are continuously recorded. In the laboratory, 10 to 40 samples per hour can be analyzed. In continuous operation, the different fluids to be analyzed are introduced successively into the Auto Analyzer by a set of electrically operated valves controlled by a programmer. One to twelve channels can be controlled during a one-hour cycle. At intervals, a calibrating sample is introduced and measurements obtained on it are used to correct automatically the routine measurements. An analysis program can be changed to another within less than 30 minutes. The used methods of determination of ammonia, cyanides and oxygen are briefly outlined. Among the automated analyses, the following are cited: hardness, alkalinity, sulfates, nitrates, nitrites, ammonia, chlorides, iodides, cyanides, fluorides, phosphates (alkaline and alkaline-earth), metabolic substances, phenols, aldehydes, DCO, and detergents.
APTIC-22458

### DETERMINATION OF ALKYLPOLYNITRATES BY ELECTRON CAPTURE GAS CHROMATOGRAPHY-APPLICATION TO AIR POLLUTION.

Anal. Chem., 39 (13):1645-1646, Nov. 1967. 6 refs.
Ettore Camera, and Dario Pravisani.
Identifiers: *Gas chromatography, *Nitrates, *Organic nitrogen compounds, Italy, Impingers.

To measure the accuracy of electron capture gas chromatography, the results of the analysis of 10 alcoholic solutions, at known concentrations, of 1-2 propylene glycol dinitrate, ethylene glycol dinitrate, and glycerol trinitrate, were considered. The corresponding standard average relative deviations are as follows: PGDN, 3.27%; EGDN, 3.88%; and NG 7.24%. In electron capture detection, the relationship between recorder response and vapor concentration is similar, under ideal conditions, to that of Beer's law for light absorption. Every increase of the vapor concentration, c, absorbs the same fraction of electrons incident upon it. For air sampling, air was bubbled at a rate of 1 liter per minute through two impinger sampling glass tubes, connected in series by means of a small hose and containing 10 ml of ethyl alcohol each. Practical analytical tests in polluted workrooms gave results agreeing with the ones obtained with the spectrophotometric method. The degrees of sensitivity ascertained correspond to the possibility of detection in the air according to the procedure described- i.e., with a sampling of 10 liters of air, of 0.02 mg/cu m (0.3 pphm) PGDN; 0.08% mg/cu m (1.4 pphm) MNT; 0.08 mg/cu m (1.3 pphm) EGDN and, by bubbling of 100 liters of air, of 0.08 mg/cu m (0.8 pphm) NG.
APTIC-22461

### EVALUATION OF AN INSTRUMENT FOR OLEFIN ANALYSIS AT SOURCE CONCENTRATIONS.

Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, Lab. of Engineering and Physical Sciences, 24p., 1961 (°). 16 refs.
A. P. Altshuller, and S. F. Sleva.
Identifiers: *Coulometric method, *Olefins, Engine exhausts, Potentiometric methods, Source sampling, Bromine compounds.

The evaluation of an instrument based on a 'bromocoulometric' method for analysis of olefins at concentrations between 20 and 1000 ppm, particularly in auto exhausts, is described. The instrument was calibrated for its vapor phase response to a number of olefins including ethylene, propylene, propadiene,, 1-butene, trans-2-butene, cis-2-butene, isobutylene, 1,3-butadiene, 1-pentene, and 2-methyl-2-butene. The possible interference of a number of substances, including sulfur dioxide, nitric oxide, nitrogen dioxide, hydrogen sulfide, n-butyl sulfide, acrolein, phenol, and m-cresol, was investigated. Sulfur dioxide, H2S, nitrogen dioxide, and acrolein do react appreciably with the brominating solution. Nitrogen dioxide lowers the response to olefins. Severe interference is experienced when the NO2 concentration equals or exceeds that of the olefins. Even when the olefins are in some excess, the interference by NO2 is sufficient to necessitate removal of most of the latter. In analyses of samples in containers, direct determination of these vapor phase interference effects may be complicated further by gas phase reactions of olefin and NO2, and perhaps by reactions with container walls. With this olefin instrument, diluted automobile exhaust and a variety of synthetic mixtures were analyzed. Results compared favorably with those obtained by the colorimetric dimethylaminobenzaldehyde method. Depending on concentrations, either method combined with gas chromatographic determination of individual olefins provides good determination of total olefins and analysis of olefin composition. (Author abstract modified)
APTIC-22463

### SIZE-SELECTIVE SAMPLERS FOR ESTIMATING 'RESPIRABLE' DUST CONCENTRATIONS.

Health Phys., (2):155-163, April 1962. 28 refs.
M. Lippmann, and W. B. Harris.
Identifiers: *Aerosols, *Particle size, *Samplers, Retention, Beryllium, Dusts, Primary metallurgical processing, Centrifugal separators, Filters, Design criteria, Uranium compounds

A family of size-selective air samplers was developed for field survey work. Each sampler operates at a flow-rate suitable to a particular suction source. They all consist of a cyclone collector followed by an efficient filter, and range in capacity from 0.9 l/min to 40 cu ft /min. The collection characteristics of the cyclones were selected so that the fraction of the sample collected on the filter would be equivalent to the material which would penetrate to the non-ciliated portions of the lung. The standard of comparison for collection efficiency is based upon human retention experiments performed by Brown and co-workers, Landahl and co-workers, and others. Representative field data are presented illustrating the relative proportions of 'respirable' and 'non-respirable' dusts at various operations in the uranium and beryllium industries.
APTIC-22475

### THE DETERMINATION OF SMALL QUANTITIES OF NITROGEN OXIDES IN FLUE GASES.

(Die Bestimmung kleiner Mengen von Stickoxyden in Abgasen). Text in German. Mikrochim. Acta, no. 1-2:166-170, 1962. 8 refs.
Wolfgang Leithe.
Identifiers: *Stack gases, *Colorimetry, *Nitrogen oxides, Europe.

A quick analytical method for determining nitrogen oxides in flue gases converts the oxides by means of diluted hydrogen peroxide in the presence of a foaming agent to nitric acid which is titrated acidimetrically. A 500 ml burette evacuated to a residual pressure of 1 mm Hg is filled with the gas to be analyzed, brought to room temperature, and the excess pressure released. Following the introduction of 20 ml 1.5% H202 solution and of 2 ml of a 1% foaming agent solution, the burette is shaken for 5 minutes and the resulting nitric acid solution is titrated acidimetrically with methyl red and methylene blue as indicators. The method yields results comparable in accuracy to results obtained by the 24 hour method using excess oxygen. The addition of the foaming agent shortens the shaking time required for complete oxidation.
APTIC-22508

### POLLUTION OF THE AIR IN ENCLOSED SPACES BY FLUE GASES FROM FURNACES.

(Verunreiningung der Raumluft durch Abgase von Feuerungsanlagen). Text in German. Oel Gasfeuerung, vol. 13:1142-1144, 1146, 1968. 3 refs.
Kurt Leichnitz.
Identifiers: *Stack gases, *Furnaces, *Analytical methods, Germany, Tracers, Carbon dioxide, Carbon monoxide, Sulfur dioxide

The use of the Draeger gas detection apparatus suitable for the detection of atmospheric pollutants from leaks in furnaces and other sources is described. A carbon dioxide cartridge is used to determine the CO2 level. Then the polytest cartridge, a highly sensitive qualitative indicator of many pollutants, is used. Only when the test result is positive is the CO tube used, preferably with an attachment which filters out hydrocarbons (gasoline, propane) for a more accurate determination of CO pollution. The determination of the SO2 level is independent on the polytest outcome and a separate sulfur dioxide cartridge is supplied with the detection apparatus. The CO2 cartridge will indicate the presence of CO2 within the concentration limits of from 0.1 to 6 vol %. The CO cartridge has a span of from 5 to 700 ppm CO; the SO2 cartridge, from 1 to 20 ppm SO2. The device can be used to locate leaks in furnaces and to trace a particular pollutant to its source. Sometimes the tracing of CO2 is difficult because it occurs normally in the atmosphere up to a concentration of 0.1 vol%.
APTIC-22509

### A TYPE OF WIND TUNNEL FOR SIMULATING PHENOMENA IN THE NATURAL WIND.

Advisory Group for Aeronautical Research and Development, Paris (France), Rept. 308, 7p, Oct. 1960. CFSTI: PB-188340
Helge Petersen.

Identifiers: *Wind tunnel, Europe, Electric power production, Nuclear power plants, Stacks, Height finding, Mathematical modeling, Simulation, Testing facilities, Diffusion, Winds, Turbulence (atmospheric), Radioactive radiation.

A description is given of a type of wind tunnel specially suited for measurements of wind pressure on buildings, of shelter effects, and of smoke concentration from a power plant chimney stack or of the diffusion of radioactivity from an atomic power plant. The tunnel design is based on a new model-law for such experiments as realized by Dr. Martin Jensen. His idea was that close to the earth, the wind develops a turbulent boundary layer with a characteristic velocity profile. A model test to determine the height of power plant stack, carried out at the Hydro - og Aerodynamisk Laboratorium, Lyngby, is mentioned. Finally, a preliminary comparison of the turbulence intensity in the model scale with that in nature is presented. (Author summary modified)
APTIC-22511

## ACCEPTABLE EQUIPMENT AND PROCEDURES-FOR EVALUATING AIR POLLUTION PROBLEMS.

Preprint, Industrial Hygiene Foundation of
America, Inc., Pittsburgh, Pa., 11p., 1960. 17 refs.
(Presented at the Industrial Hygiene Foundation,
Engineering Conference, Oct. 27, 1960.)
Roy O. McCaldin.
Identifiers: *Samplers, Particulates, Suspended particulates, Measurement methods, Lead peroxide candle, Particle size, Sampling methods, Hi-vol samplers, Impingers, Membrane filters, Glass fabrics, Fluorides, Carbon monoxide, Nitric oxide (no), Nitrogen dioxide (no2), Sulfur oxides, Hydrogen sulfide.

When choosing equipment to make air quality measurements, it is necessary to estimate the possible pollutants as well as the degree of accuracy and thoroughness with which they must be measured. Availability and reliability of equipment, cost of operation, and skill required for satisfactory results are also factors to be considered in equipment choice. The hi-volume sampler, which consists of a vacuum cleaner motor with suitable mounting to accommodate an 8 by 12-in. filter, is frequently used to measure suspended particulates which may consist of smoke, dust, or other solids sufficiently small to remain airborne for long periods of time. Fiber glass filters commonly used with this sampler collect practically all particulates down to 0.3 micron in diameter, while the simplest analysis is that for total weight of material collected on the filter. Results of analysis of suspended particulate samples collected from 1953 to 1957 by the National Air Sampling Network are presented tabularly. Automatic strip filter paper samplers commonly use a diaphragm pump to draw air through a portion of the filter tape at a sampling rate of about seven liters per minute. The amount of smoke or other suspended particulate collected with this type equipment shows up as various shades of gray; light transmission, sampling time, and flow rate are used to compute results. A major modification in this type of sampler employs a membrane filter tape instead of Whatman filter paper. Laboratory gas washing bottles, bubblers, impingers, and midget impingers are used with a wide variety of both commercial and home-made equipment for collecting gas samples. The Thomas Autometer and Titrilog are designed for determination of sulfur compounds; the MSA Lira uses infrared absorption measurements to determine carbon monoxide concentrations in air; and the Kruger apparatus has been used to measure nitric oxide and nitrogen dioxide. Dustfall samplers are designed to collect the coarse particulates and droplets which settle out more or less rapidly near sources of emission. The lead peroxide candle sampler provides a simple, economical method of estimating sulfation rates of the ambient atmosphere. Hydrogen sulfide will blacken lead bearing materials, and this principle has been employed to estimate its presence in the atmosphere. Some of the corrosive effects of pollutants may be evaluated by a test based on weight gain that occurs when a thin iron disc is exposed to the atmosphere. Lime-treated filter papers have been used to determine comparative fluoride levels in the environment.
APTIC-22517

## FAR-INFRARED LASING IN H2S, OCS, AND SO2.

Appl. Phys. Letters, 14 (4):135-136, Feb. 15, 1969.
10 refs. CFSTI, DDC: AD 696272
J. C. Hassler, and P. D. Coleman.
Identifiers: *Carbon oxysulfide, *Lasers, *Sulfur dioxide, *Hydrogen sulfide, Sulfides, Infrared radiation.

Twenty-four lasing lines were found in a hydrogen sulfide laser in the range from 33 to 225 micron; three lines in sulfur dioxide at 141, 151, and 215 micron; and two lines in carbon oxysulfide at 123 and 132 micron. Comparing H2S to H20, the pulse power outputs are about equal and the lines about as numerous. However, while the H20 lines essentially lase during the exciting 5-microsecond current pulse, the H2S lines turn on about 20-30 microseconds after the 5-microsecond current pulse and last for 20 to 100 microseconds. (Author abstract)
APTIC-22555

## THE ELECTRICAL CHARGING OF SMALL PARTICLES AT LOW PRESSURES.

Minnesota Univ., Minneapolis, Particle
Technology Lab., A.E.C. Contract AT (11-1)-1248,
Progress Rept. 7, Pub. 139, 8p., Nov. 1969. 17 refs.
CFSTI: COO-1248-18
Benjamin Y. H. Liu, and Kenneth T. Whitby.
Identifiers: *Aerosols, *Particle size, *Electric charge, Research programs, Smog, Electrostatic aerosol generators, Experimental equipment, Pressure.

The electrical charging of small aerosol particles, as well as the development of a system of aerosol particle counters was studied. The effects of such variables as pressure, electric field, ion concentration, and particle size were investigated over a wide range of conditions. One study concerns the development of a low pressure electrical method for the sizing and classification of aerosol particles in the 0.02 to 12 micron range; another concerns the accurate measurement of the slip correction to Stokes law for solid latex particles. A pulse-precipitating electrostatic aerosol sampler was developed, as well as an improved aerosol generator of the condensation type for producing monodisperse test aerosols. The aerosol counting system, for measuring the size distribution of atmospheric aerosols over a size range from 0.002 to 10 micron, was used in the summer of 1969 to study the characteristics of smog particles in Los Angeles. Publications resulting from this contract are listed. During the course of the fundamental aerosol charging studies, it was observed that the pressure dependence of the aerosol mobility could be made the basis of a method for measuring particle size. Studies have begun on the filtration of aerosols by fibrous filters, inertial impaction, and the charging of aerosol particles by gaseous ions.
APTIC-22557

## THE FLOW METHOD OF ULTRAMICROSCOPE MEASUREMENT OF THE PARTICLE CONCENTRATION OF AEROSOLS AND OTHER DISPERSION SYSTEMS.

Zap. Akad. Nauk SSSR, 63 (2):155-158, 1948. 1 ref.
Translated from Russian. Fort Detrick, Frederick,
Md., 4p., Jan. 7, 1950. CFSTI, DDC: AD 682910
S. Deriagin, and G. Vlasenko.
Identifiers: *Aerosols, *Particle counters, *Microscopy, Ussr.

Shortcomings of the existing ultramicroscopic methods of making particle counts of aerosols are overcome in the method of low ultramicroscopy. This method is based on making the particle count in a continuous stream of aerosol flowing in a direction parallel to the line of sight, with the particles traversing a zone of illumination in a set time. Particle concentration is obtained by dividing the total observed number of flashes made by particles crossing the zone of illumination by the volume of the aerosol, as measured by a separate volume gauge, flowing over the field. The flow method speeds up the count of small particles by 100 times, making it possible to measure a concentration of 0.001 cm in one min. As compared to other counting methods, the flow method has the following advantages: use of simpler gas cell, absence of dispersed light from surfaces enclosing the count volume, and the absence of error due to settling of particles on these surfaces. In addition, there is no need of high magnification even in the measurement of high concentrations. The method may lead to an automatic method for aerosol particle count.
APTIC-22568

## PLASMATIC ARC FOR CLINICAL CHEMICAL ANALYSES.

(Plasmabogen fuer klinisch-chemische Analysen).
Text in German. Z. Klin. Chem. Klin. Biochem.
(Munich), 4 (4):217-219, 1966. 31 refs.
R. Herrmann and K. Roetger.
Identifiers: *Aerosols, *Spectrophotometry, *Metal compounds, Carbon black, Germany, Mists, Arsenic compounds, Dissociation.

A direct current carbon arc burner is described which generates temperatures exceeding 3000 C and is suited for the detection of more elements in biological fluids than can be detected by chemical burners or by the relatively recent atomic absorption burners whose temperatures are not high enough to overcome the dissociation energy of some elements. As in emission and absorption flame photometry, the liquid to be analyzed is sprayed into the flame in the form of a mist. The circular water-cooled anode is of carbon; the cathode in the form of a bar, also water-cooled, is of thorium coated tungsten. The space between the electrodes is divided by pure carbon dividers into three chambers into which welding argon gas is blown to stabilize the electric arc. The tungsten cathode likewise burns in a chamber fed with argon. The line emission of the material sprayed into the arc is observed through an opening in the middle chamber. Twenty-six elements (Ag, Al, As, B, Ba, Be, Bi, Cd, Co, Cr, Fe, Hg, Mn, Mo, Ni, P, Pb, Sb, Se, Si, Sn, Sr, Te, Ti, V, and Zn) can be detected by this method within concentration limits of from 0.1 to 100 ppm depending on the element.
APTIC-22593

## AUTOMATED DUST MEASUREMENT: THE DIFFRACTION SIZE-FREQUENCY ANALYSER.

J. Mine Ventilation Soc. S. Africa, 20 (2):21-30,
Feb. 1967. 5 refs.
J. H. Talbot.
Identifiers: *Dusts, *Particle size, *Diffraction, Africa, Measurement methods, Automatic methods.

In the past, respirable surface area of dust has been determined by counting the number of dust particles of each size under a microscope. This technique is time- and labor-consuming. A new automatic instrument, the Diffraction Size-Frequency Analyzer, uses the reciprocal property of diffraction to determine total and respirable dust surfaces and the size distributions of dust samples at the rate of 10 samples per min. A mercury vapor lamp in the analyzer illuminates the specimen through a narrow slit in a metal plate. A second apertured metal plate restricts illumination to the desired part of the specimen. A large-aperture converging lens focuses an image of the diffraction pattern on a photographic transparency called a wave vector filter. All light transmitted by the transparency is collected by a photomultiplier the

current of which is recorded by a potentiometer or by a digital voltmeter and printout or punch unit. The analyzer is suitable for use with any type of dust sample and obtains reasonably accurate results from very sparse samples. Though still in its infancy, diffraction size-frequency analysis offers many possibilities in dust sample evaluation for both research and control purposes.
APTIC-22595

### ANALYTICAL STUDY OF CONTAMINANT AND ATMOSPHERIC SENSOR. PHASE I.

Contract NAS 1-7260, SPO 20224, NASA CR-1375, 133p., Sept. 1969. 3 refs.
Personal Author Not Recorded.
Identifiers: *Spacecraft atmospheres, *Mass spectrometry, Monitoring, Design criteria, Mathematical analyses, Hydrocarbons, Methanes, Hydrogen, Nitrogen, Carbon dioxide, Carbon monoxide, Oxygen, Vapors.

Results are given of a detailed analysis of the modifications necessary to allow the Two Gas Atmosphere Sensor System to monitor selected atmospheric constituents and contaminants in both helium-oxygen and nitrogen-oxygen atmospheres, for application to spacecraft atmosphere control. The selected constituents are hydrogen, helium or nitrogen, oxygen, carbon dioxide, water vapor, carbon monoxide, methane, and total hydrocarbons. Several approaches utilizing the Two Gas Sensor, which consists of a small single focusing 90 deg magnetic sector-type mass spectrometer, were analyzed; results indicated that the accumulator cell approach offered the most feasible solution. A design for a contaminant and atmospheric sensor using the accumulator cell, as applied to CO, is presented, in which performance goals as well as weight, power, and size specifications are met. Theoretical aspects are discussed, and details are given of analyzer layout, a support electronics subsystem, power requirements, pumping, sample inlet, accumulator cell and valves, ion source, and mechanical design and packaging.
APTIC-22597

### VOLATILIZATION AND DECOMPOSITION OF POLYNUCLEAR AROMATIC HYDROCARBONS OCCURRING DURING THE USUAL COURSE OF PROCEEDINGS FOR THE CONCENTRATION OF ATMOSPHERIC DUST EXTRACTS.

(Sulla volatilizzazione e la decomposizione degli idrocarburi policiclici aromatici nel corso degli abituali procedimenti per la concentrazione degli estratti di pulviscolo atmosferico). Text in Italian. Nuovi Ann. Igiene Microbiol. (Rome), vol. 17:311-324, 1966. 37 refs.
P. Valori, C. Melchiorri, A. Grella, and G. Alimenti.
Identifiers: *Particulate sampling, *Polynuclear compounds, Carcinogens, Italy, Dusts, Chromatography, Spectrophotometry, Sampling methods, Acenaphthalenes, Anthracenes, Fluorenes, Naphthalenes, Decomposition, Volatility.

An important problem in the sampling and determination of polynuclear aromatic hydrocarbons is the loss of compounds during the preparation of extracts for chromatographic separation and spectrophotometric determination. A report is given of a systematic study of a series of such hydrocarbons usually found in polluted air, with a view to discovering the causes of such losses and the magnitude of errors introduced at this stage. A total of 17 hydrocarbons were studied. The results, which are presented in a series of tables, represent not so much a quantitative statement of actual errors introduced into the analysis (which would be statistically significant) as it does a qualitative statement of the probablity of such error, against which those conducting such tests should be on their guard. A general observation was that the compounds most seriously affected by such error were those not suspected of being carcinogenic. The highest losses were experienced with naphthalene, acenaphthene, fluorene, and 9,10-dihydroanthracene.
APTIC-22601

### SAMPLING DUST-LADEN GASES.

For primary bibliographic entry see Field 02.
APTIC-22618

### CONTRIBUTION TO THE BIOCHEMICAL FUNDAMENTALS OF HARTEL TURBIDITY TEST.

For primary bibliographic entry see Field 08.
APTIC-22626

### CHROMATOGRAPHIC SEPARATION OF POLYCYCLIC AROMATIC HYDROCARBONS. METHOD FOR THE CONCENTRATION AND PRELIMINARY PURIFICATION OF SAMPLE EXTRACTS OF ATMOSPHERIC DUST.

(Separazione chromatographica degli idrocarburi policiclica aromatica. Metodo per la concentrazione e la preliminare purificazone degli estratti di campioni di pulviscolo atmosferico). Text in Italian. Nuvoi Ann. Igiene Microbiol. (Rome), vol. 17:351-367, 375-382, 1966. 35 refs.
P. Valori, and A. Grella.
Identifiers: *Column chromatography, *Aromatic hydrocarbons, *Polynuclear compounds, Italy, Dusts, Experimental methods.

The factors which principally affect the chromatographic separation on column of the polycyclic aromatic hydrocarbons are discussed. Structural factors involved in the relative chromatographic adsorbability of these compounds as well as other factors classified as inherent to the chromatographic column, are included in detail. Adoption of different techniques by different workers contributes to the variability of results. A method is described which succeeds in obtaining the concentration of polycyclic constituents of the extracts by absorption on alumina, the purification of the extracts from tars and colored materials, and a preliminary separation of the polycyclic aromatic hydrocarbons into two fractions. (Author abstract)
APTIC-22695

### RESEARCH OF CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS FROM AUTOMOBILE EXHAUST GAS.

(Ricerche sugli idrocarburi aromatici eterociclici ad azione cancerigena nei gas di scarico degli autoveicoli). Text in Italian. Riv. Ital. Igiene (Pisa), vol. 26:217-230, 1966. 30 refs.
A. Candeli.
Identifiers: *Carcinogens, *Engine exhausts, *Benzenes, Italy, Benzene-soluble organic matter, Chemical methods, Xylenes, Polynuclear compounds.

The chemical analysis of 5.86 g of tar recovered from the condensed water derived from exhaust gas (by extraction with benzene), and emitted by an engine operating with an experimental fuel containing only benzene and xilene (50%/50%), gives the following results: small amounts of dibenz (a,j)acridine (56 micrograms/100 g of tar); phenol (g 8.62%); pyrene (g 0.86%). The isolation of aromatic polycyclic hydrocarbons such as dibenz (a,j)acridine (belonging to a group of carcinogenic compounds already identified in cigarette smoke) from the combustion of pure hydrocarbons such as benzene and xilene is discussed. (Author abstract)
APTIC-22698

### A METHOD OF TEST FOR SO2 AND SO3 IN FLUE GASES.

Bureau of Mines, Washington, D. C., Rept. of Investigations 4618, 9p., Jan. 1950. 6 refs.
A. A. Berk, and L. R. Burdick.
Identifiers: *Colorimetry, *Sulfur dioxide, *Sulfur trioxide, Stack gases, Gas sampling, Design criteria, Sulfites.

In the course of a study of the formation of external deposits on tubes in water-tube boilers it became desirable to determine the sulfur dioxide and sulfur trioxide in the flue gases. Determinations made by the A.S.M.E. method for SO2 and SO3 in gaseous products of combustion did not give accurate results. Minute quantities of copper, present in the flue gases from the coal in use, caused oxidation of sulfite in the absorption bottle and the carbon dioxide in the flue gases caused high values for SO2. The A.S.M.E. test procedure was revised to prevent oxidation of sulfite in the absorption bottle and to allow for the effect of CO2; subsequent analyses of flue gases produced reliable results. The revised procedure is described. The charge to the absorption bottle is 100 ml of 0.1 normal NaOH, 5 ml cp benzyl alcohol, 14 mg sodium sulfate, and one drop benzaldehyde. Thirty mg of paraminophenol HCl are added to the solution exactly 2 minutes before the start of the run; the paraminophenol HCl is mixed with mannitol in the proportion of 1 to 35. A measured sample of gas is drawn through one absorption bottle for half of the run and through the other for the full run. The first step is a titration with 0.2 normal HCl to an end point of 4.1 by means of a pH meter. The SO3 is then determined by the regular benzidine method. (Author abstract modified)
APTIC-22700

### DROPLET SIZE MEASUREMENTS FOR LIQUID STREAMS INJECTED INTO A LOW-PRESSURE CHAMBER USING A LIGHT TRANSMISSION TECHNIQUE.

Naval Postgraduate School, Monterey, Calif., Dept. of Aeronautical Engineering, Thesis (M.S.), Oct. 1969, 44p. 18 refs. CFSTI, DDC: AD 706024
Robert Orrin Corey.
Identifiers: *Droplets, *Spectrophotometry, *Particle size, Sprays, Design criteria, Flow rates, Density, Pressure.

An apparatus is constructed for optical investigation of the sprays produced by liquid injection into a vacuum using various nozzle orifice sizes and driving pressures. A light transmission technique is employed to measure the mean diameter of the droplets in acetone sprays. Independent calculation of the densities of the sprays allowed the droplet sizes to the established by measuring the optical transmittance of a single spectrally pure wavelength of light through the sprays. A graph of droplet diameter, normalized for nozzle orifice diameter, vs. driving pressure is constructed. Mass and volume flow rates for the liquid injection system are calculated. (Author abstract modified)
APTIC-22708

### ACTIVATION ANALYSIS OF AEROSOLS.

J. Geophys. Res., 69 (14): 2881-2885, July 15, 1964. 9 refs.
C. M. Gordon, and R. E. Larson.
Identifiers: *Aerosols, *Chemical composition, *Radiation measuring systems, Winds, Haze, Precipitation, Bromine compounds, Manganese compounds, Sodium compounds, Gamma radiation.

The use of radioactivation analysis to determine the concentration of particular elements in routine daily samples of atmospheric aerosols is described. Sodium, manganese, and bromine samples were measured each weekday for a period of about three months. The samples were exposed to neutrons in a reactor; then the gamma-ray spectrums were measured. The technique requires no radiochemical treatment of the samples. The concentrations of the elements are determined by comparing the decay times with a blank sample. A discussion of possible sources of measurement error is included. Meteorological factors taken into consideration include wind direction, precipitation, and the presence of smoke or haze.
APTIC-22714

### DEVELOPMENT OF MARK I RADIOMETRIC THERMASONDE (TM) AND SIMULATION AND

### EXPERIMENTAL STUDIES FOR PASSIVELY PROBING TEMPERATURE STRUCTURE WITHIN THE FIRST MILE OF THE ATMOSPHERE. (FINAL REPORT).

Sperry Rand Research Center, Sudbury, Mass.
and Sperry Microwave Electronics Co.,
Clearwater, Fla., NAPCA Contract PH22-68-22,
SRRC-CR-70-6, 105p., 1969. 3 refs. CFSTI: PB
192333
W. D. Mount, A. C. Anway, C. V. Wick, C. M.
Maloy, and R. Wilt.
Identifiers: *Radiometric equipment, *Inversion, *Temperature sensing instruments, Design criteria, Meteorological instruments, Lower atmosphere, Temperature (atmospheric), Lapse condition, Temperature gradient.

Background material on theoretical and practical aspects of the use of millimeter wave radiometric equipment for remote probing is presented. Specifications for development of the Mark I Radiometric THERMASONDE are listed and performance characteristics are described. The paper, 'Use of Millimeter Wave Radiometry to Remotely Measure Atmospheric Stability,' presented at the Symposium on Advances in Instrumentation for Air Pollution Control, which describes work accomplished under this contract is given as Appendix I of this report. Simulated and experimental radiometric results are presented and discussed for climatological and equipment effects in the observing of lapse, ground-based, and elevated inversions. A nonlinear nomogram is developed to correct for radiometric smoothing of intensity and height of ground-based inversions. Different observing modes and signal processing techniques appear to assist in the interpretation of radiometric soundings for use in detecting elevated inversions. (Author abstract modified)
APTIC-22720

### CALIBRATION OF A TWO-STAGE AIR SAMPLER.

California Univ., Los Alamos Scientific Lab., N.
Mex., AEC Contract W-7405-ENG. 36, 7p., Aug.
1969. 22 refs. CFSTI: LA-4234
Harry J. Ettinger, and George W. Royer.
Identifiers: *Dusts, *Samplers, *Calibration methods, Particles size, Centrifugal separators, Glass fabrics, Aerodynamics, Flow rates.

Several criteria defining maximum safe air concentrations for occupational exposure are based on the quantity of contaminant that penetrates into the lower lung. This is defined as the respirable dust. A two stage sampler consisting of a cyclone sampler followed by a high-efficiency filter will approximate the respirable dust curve if the proper flow rate is chosen. A two-stage sampler consisting of a nylon cyclone, followed by a glass fiber filter was calibrated using monodisperse test aerosols. Cyclone efficiency, as a function of sampling flow rate, and aerosol aerodynamic diameter were determined. At a flow rate of 1.7 liters/min, this sampler provides a good estimate of 'respirable dust' concentration. (Author abstract modified)
APTIC-22722

### SMALL DROPLET MEASURING TECHNIQUE.

TRW Systems, Redondo Beach, Calif., Power
Systems Div., AFRPL Contract F04611-67-C-
0105, AFRPL-TR-67-295, TRW Rept. 4768.67-006,
70p., Feb. 1968. 33 refs. CFSTI, DDC: AD 828005
B. J. Matthews, R. R. Wuerker, and D. T. Harrje.
Identifiers: *Holography, *Droplets, *Particle size, Missiles and rockets, Photometric methods, Data analysis, Design criteria, Lasers.

A study and experimental program which involves the detection and analysis of size distributions of droplets associated with the injection process in liquid propellant rocket engines is described. Applicable methods of detecting and recording rocket injector droplet spray distributions are determined through a literature review. Methods of data reduction are improved so that large quantities of droplet data may be reduced economically. The design, assembly, and feasibility demonstration of the droplet detection techniques are discussed. Attention is given to the application of pulsed laser holography to droplet detection. (Author abstract modified)
APTIC-22729

### DEVELOPMENT OF TRACER TECHNIQUES TO ESTABLISH GEOGRAPHICAL DISTRUBUTION OF POLLUTION FROM A STACK USING NEUTRON ACTIVATION TECHNIQUE. PROGRESS REPORT.

Industrial Hygiene Foundation of America, Inc.,
Pittsburgh, Pa., 33p., July 1955. 1 ref.
George F. Haines Jr., Herman Cember, and W. C.
L. Hemeon.
Identifiers: *Neutron activation analysis, *Plume behavior, *Point sources, Stack gases, Hemeon automatic smoke samplers, Experimental methods, Field tests, Dispersion, Tracers, Transport, Antimony compounds, Oxides.

Field trials are reported in which antimony oxide powder is injected into the base of a 400-ft stack in a zinc smelter located in a hilly area 30 mi northwest of Pittsburgh. Field samples were collected with an automatic smoke sampler using a sampling element of filter paper in roll form. Twelve such units were located in an easterly sector spanning about 45 deg at various distances up to 7 mi. Three runs for periods up to 8 hrs were made in March and April 1955. Details of equipment, test procedures, and meteorology are given along with data analysis. Background interference from soot and filter paper limited the sensitivity of the technique to about 0.2 micrograms of antimony; methods are being developed to quantitatively separate antimony from filter paper and soot, and are expected to increase the sensitivity to about 0.005 micrograms of antimony. In addition, the amount of antimony oxide injected into the stack gases will be increased. Early field trials suggest that variation in smoke concentrations from hour to hour is apparently due much less to changes in rates of smoke production than to changes in atmospheric conditions.
APTIC-22733

### INVESTIGATION ON NEUTRON ACTIVATION STACK GAS TRACER TECHNIQUE. PROGRESS REPORT.

Industrial Hygiene Foundation of America, Inc.,
Pittsburgh, Pa., 32p., Feb. 1956. 1 ref.
George F. Haines Jr., Herman Cember, and
Wesley C. L. Hemeon.
Identifiers: *Neutron activation analysis, *Point sources, *Antimony compounds, Stack gases, Chemical methods, Hemeon automatic smoke samplers, Field tests, Dispersion, Plume behavior, Tracers, Transport, Oxides, Radioactive radiation.

Analytical and field work is reported in which antimony oxide powder is used as a tracer to investigate plume dispersal from a 400-ft stack, as measured by neutron activation analysis of smoke samples. A simple wet chemistry technique was developed and applied to separate the antimony from background soot and filter paper interferences, which had limited the sensitivity. The filter paper samples, after neutron activation, are treated with dilute acid which permits removal of insoluble substances including the filter paper. The antimony in solution is then selectively precipitated by reduction with chromous chloride, the precipitate concentrated, and its activity measured. A 6-10 fold reduction in background activity is achieved with this technique and, if decay time is limited to a few days, quantities of antimony well below 0.01 microgram and with a sensitivity equivalent to 0.003 microgram antimony (one standard deviation) can be determined. Appendices give details of the analytical techniques and studies. After four field tests showed infrequent pickup of measurable quantities of tracer in the smoke samples, the 12 samplers were relocated. Results from tests in the new location are not yet available.
APTIC-22734

### CRC DIESEL SMOKEMETER CALIBRATION TESTS 1967.

Proj. CD-4-58, Rept. 421, 56p., June 1969. 3 refs.
Personal Author Not Recorded.
Identifiers: *Smokemeters, *Calibration methods, Engine exhausts, Stack gases, Soot, Smokes, Diesel engines, Ringelmann chart.

An experimental program to correlate and calibrate seven types of commercially available smokemeters is described. Exhaust filtering methods were used to determine exhaust soot concentrations. Ringelmann ratings were made for two test engines, using two different fuels. Differences in Ringelmann ratings are attributed to the fact that readings are taken at different heights above the stack outlet. Problems encountered with each instrument are disclosed. Measurement precision and meter response vary for the range of smoke levels observed. It is probable that the effect of varying exhaust stack diameter on full-flow smokemeter readings can be calculated from the Beer-Lambert Law. Smoke inhibiting fuel additives were not included in the program. Comparison of the program results with published data indicates good agreement except that one instrument read high, one read low above certain values, and a third read consistently low. Future work is suggested to resolve these exceptions and update the correlations, if necessary, when other data are obtained. (Author summary modified)
APTIC-22735

### THE APPLICATION OF RADIOISOTOPE METHODS TO MEASUREMENT OF SULFUR DIOXIDE IN INDUSTRIAL STACK GASES.

In: Studies of the Measurement of Sulfur Dioxide
in Stack Gases. International Chemical and
Nuclear Corp., Pittsburgh, Pa., Nuclear Science
Div., AEC Contract AT (30-1)-3881, Rept. NSEC-
3881-1, p. 177-249. Dec. 1967. 58 refs. CFSTI:
TID-25137
R. C. Koch, C. R. Wilson, and R. L. Bogner.
Identifiers: *Stack gases, *Radiation measuring systems, *Sulfur dioxide, Feasibility studies, Charcoal, Stacks, Continuous monitoring, Stack sampling, Absorption, Design criteria, Fluorescence, Gamma radiation, X-rays.

An investigation, comparison, and evaluation of the technical and economic parameters of several prospective methods of radioisotopic measurement of the sulfur dioxide in stack gases was performed. In-stack and side-arm systems were evaluated with the latter offering the greater advantage. The basic approach selected was the use of a sorbent material to remove the SO2 selectively from the side-arm flow. Cyclohexanone was the best sorbent material, principally due to the fact that it did not emit secondary radiation when exposed to the energy sources under consideration and it permitted continuous monitoring. Charcoal was comparable in most technical respects and it was cheaper, but could not conveniently permit continuous monitoring. Of the energy sources considered, only x-ray fluorescence and prompt gamma radiation met the technical requirements of the system function, and the prompt gamma radiation appeared to offer fewer design problems. For a detector, the 5 by 5 in cylindrical thallium-activated, sodium-iodide scintillator was selected. Associated electronics would include conventional power supplies and regulators. The prototype design was principally conceptual at contract termination.
APTIC-22736

### MEASUREMENT OF SULFUR DIOXIDE IN STACK GASES.

In: Studies of the Measurement of Sulfur Dioxide
in Stack Gases. Industrial Nucleonics Corp.,
Columbus, Ohio, Federal Systems Div., AEC
Contract AT (30-1)-3882, Rept. NYO-3882-1, p. 5-
176, Jan. 13, 1968. 80 refs. CFSTI: TID-25137
Boong Y. Cho.

Identifiers: *Stack gases, *Radiation measuring systems, *Sulfur dioxide, Feasibility studies, Fly ash, Stacks, Height finding, Instrumentation, Chlorides, Mercury compounds, Sulfites, Chemical reactions, Condensation, Fluorescence, Ions, X-rays.

From an analysis of radioisotope methods of sulfur dioxide measurement in stack gases, two possible systems are recommended: the direct measurement system in gaseous phase using an X-ray fluorescence technique, and the mercurous chloride system. The proposed direct measurement system consists of a sampling tube, a measurement cell, a radiation source-detector unit, an electronic signal processor, and a readout device. The sampling tube includes a flyash filter and probably a moisture condensor unit. It uses a 10 mCi source of Fe-55 and a proportional counter. Electronics include a preamplifier, a linear pulse amplifier, threshold level detectors, an automatic gain control circuit, and a manual source decay compensation circuit. The detector may be operated at high temperature to minimize the moisture condensation. The system is attractive because of its directness, simplicity, and does not require frequent supply of chemical reagent. However, it is recommended as the second choice to the mercurous chloride system described below since its probability of success is not as good as the system of first choice, and if it is successful, there is a chance of requiring frequent cleaning or changing of radiation windows and readjusting or recalibrating the gauge. A system utilizing a chemical reaction of mercurous chloride will offer many advantages over other methods of measurement. This reaction is specific to sulfite ions and no interference from other components of stack gas is expected. The concentration of mercury atoms in the solution is detected either by an X-ray fluorescence method or by an attenuation measurement of low-energy X-rays. Since the atomic number of mercury (80) is much higher than that of sulfur (16), one can use a higher energy source such as Cd-109 (22 keV). The overall fluorescence efficiency is high for this system, and the required source activity level is expected to be lower than that which will require close control and periodic inspection (10 micron Ci of Cd-109). This alleviates the problem of close surveillance of the instrument. Except for the addition of a liquid flow system and a chemical reaction cell, the construction is very similar to that of the direct measurement system described above. The sample conditioning is not as critical. A sodium iodide crystal may be used for the detection of radiation, and thus, no preamplifier will be required. The system will have an automatic gain control and a manual source decay compensation circuit (which can be made automatic using a servo motor if needed).
APTIC-22737

### FINE PARTICLE-SIZE CLASSIFICATION.

Trans. Inst. Chem. Engrs. (London), vol. 43:T199-T205, 1965. 5 refs.
C. R. G. Treasure.
Identifiers: *Operating variables, *Particle size, *Design criteria, Great britain, Particulate classifiers, Centrifugal separators.

The principles necessary for an ideal particle size classifier are defined: (1) a definite system of forces acting on each particle (fluid drag vs. centrifugal force); (2) a defined zone for particle entry and separation, which optimally will possess depth; (3) uniform and discrete particle introduction into the classification zone; and (4) immediate removal of the powder fractions after classification. Means for assessing the effectiveness of a classification system are considered to permit comparisons between machines. Five machines for fine size separation are described and the theory of operation and some test data are given: solid-bowl centrifuge; hydrocyclone; Hosokawa Micro-Separator; Head, Wrightson air classifier; and Alpine Mikroplex classifier. In none of these are all four principles of classification successfully applied. The information needed and the steps to be taken in designing a classification system are outlined.
APTIC-22744

### THE DETERMINATION AND CONTROL OF INDUSTRIAL DUST.

Public Health Service, Washington, D. C., Bull.
217, 167p., April 1935. 73 refs.
J. J. Bloomfield, and J. M. Dallavalle.
Identifiers: *Dusts, *Measurement methods, *Control methods, Industrial emission sources, Collectors, Exhaust systems, Protective masks, Flow rates, Ventilation, Design criteria.

The purpose of this bulletin is to present the methods and instruments used in conducting dust studies in industry, the manner of interpreting the results of such studies, and their practical application to industrial problems, especially those phases dealing with the control of the dust hazard. Included are chapters on the design of exhaust hoods, the design of local exhaust systems, exhaust ventilation in practice, methods of dust collection and dispersal, measurement of air flow, and types of apparatus for personal respiratory protection.
APTIC-22751

### RAIN SCAVENGING STUDIES.

Michigan Univ., Ann Arbor, Dept of Meteorology
and Oceanography, AEC Contract AT (11-1)-1407,
Office of Research Administration Proj. 06867,
Progress Rept. 6, 97p., Dec. 1969. 13 refs. CFSTI:
C 001407-33
A. Nelson Dingle.
Identifiers: *Tracers, *Rain, Droplets, Particle size, Spectrometry, Transport, Beta particles, Radioactive tracers, Neutron activation analysis, Calibration methods, Pollens, Lead compounds, Isotopes.

The construction and instrument installation of a rain sampling station in Illinois is described. The measurement data obtained are sparse, and opportunity for good tracer experiments (using indium flares) did not develop, because of a severely dry season. Those data that were obtained are presented in terms of tables, graphs, and weather maps. Analyses were made for radioactivity, pollen, lead, oxygen-18, deuterium, and trace metals. Objectives of the program are not specified. Laboratory work has progressed in the improvement of the neutron activation analysis procedure, including measurement of beta-radiation. Measurements of the particle size distribution of the flare-generated indium tracer yield a bimodai curve which is not clearly understood and calls for further experiments. Calibration of the drop-size spectrometer is described; improved means of producing uniform small drops are needed. (Author abstract modified)
APTIC-22754

### METHOD OF DETERMINING DYNAMIC SHAPE COEFFICIENT AND APPARENT DENSITY OF NONSPHERICAL AGGREGATED AEROSOL PARTICLES WITH A SOLID DISPERSION PHASE.

(Sposob opredeleniya dinamicheskogo
koeffitsienta formy i kazhushcheysya plotnosti
nesharovidnykh agregirovannykh chastits
aerozoley s tverdoy dispersnoy fazoy). Text in
Russian. Kolloidn. Zh., 30 (2):304-307, 1968. 13
refs.
A. T. Litvinov.
Identifiers: *Aerosols, *Particle shape, *Statistical analyses, *Density, Carbon black, Ussr, Sedimentation.

A method is presented for determining the dynamic shape coefficient and apparent density of irregularly shaped aggregated aerosol particles with a solid dispersed phase. Statistical treatment of available experimental data on sedimentation rate for nonspherical carbon black particles showed the size distribution to be expressed by the so-called normal distribution law. The dynamic shape coefficient was established as 9.9 and the apparent density of the carbon black aggregates as 189 kg/cu m.
APTIC-22761

### ANALYSIS OF ATMOSPHERIC DUST BY ELECTRON OPTICS. (TERMINAL REPORT).

Saint Louis Univ., Mo., PHS Grant 2R01 AP
00372, 27p., 1971 (°). 6 refs.
Harry U. Rhoads.
Identifiers: *Dusts, *Chemical composition, *Electron microscopy, Urban areas, Particulates, Analytical methods, Collectors, Electrostatic precipitators, Photographic methods.

The feasibility of electron optical techniques for determining the chemical composition of airborne particulates in a metropolitan area was evaluated. The samplers, which were placed on the roof of a two-story building, were an electrostatic precipitator with Millipore filter paper and a Rotorod collector. Although primarily an electron microscope, the basic optical instrument was used as an electron diffraction camera. The diffraction patterns obtained permitted identification of the exact chemical compound of a particulate. An accessory to the electron microscope was an electron microprobe unit which produced a record and an identification of the elemental composition of the particulate. When neither method yielded identifying information, a light microscope with a trinocular eyepiece mount for photography was employed. Particles identified were wood fibers; carbon from burning coniferous wood; carbon particles from auto exhaust; barium silicate, copper spheres; iron oxides; oil soot; copper arsenate; loellingite and chrysocolla; and copper with traces of beryllium, nickel, and iron. The light microscope characteristics of each are summarized and the method of identification noted.
APTIC-22782

### THE RAPID MEASUREMENT OF TOXIC GASES AND VAPORS.

Preprint, 9p., 1960. 8 refs. (Presented at the
International Congress on Occupational Health,
13th, New York, July 25-29, 1960.)
Tetsuzo Kitagawa.
Identifiers: *Colorimetry, *Design criteria, Portable, Japan, Gases, Vapors.

For measurements of toxic gases or vapors in a working atmosphere, the measuring method should be rapid and simple in operation, need only a small quantity of sample air, have high accuracy and selectivity, be portable, and be able to record the results. These requirements are met by improved detector tubes which permit quantitative identification of gas concentrations lower than 0.1%. The glass tubes (approximately 2 to 4 in. in inner diameter) are packed with fine grains of silica gel, alima gel, or glass that are impregnated with suitable chemical reagents. After packing, the tubes are hermatically sealed at both ends. When the ends are cut off and sample air or gas drawn through the tube, the reagent reacts with the specific gas contained in the sample to change its color and provide a 'length of stain' or color hue indication from which the concentration of the gas is determined. Tubes are now available for 40 kinds of toxic and flammable gases; they are widely used in Japan for purposes of industrial hygiene, process control, prevention of gas explosion, and analyses of industrial waste gas and water.
APTIC-22798

### SOME TOPICS CONCERNING EXPERIMENTAL INVESTIGATION OF AIR IONS.

American Inst. of Medical Climatology,
Philadelphia, Pa., Proc. Intern. Conf. Ionization
Air, Philadelphia, Pa., 1961, 1 (9):25p. 34 refs.
(Oct. 16-17.)
R. Siksna.
Identifiers: *Aerosol generators, *Ions, Sweden, Particle counters, Design criteria, Density, Electrical properties.

Artificial production of air ions is of importance for two reasons: the properties of air ions can be experimentally investigated with certainty only when the ions produced are pure air ions without any by-products, usually produced simultaneously with the production of the ions; and it is of importance to produce air ions of a certain concentration and of a certain polarity in a closed vessel or room, especially for the investigation of the biological influence of air ions. The generator with a tritium foil as the ion source seems to be an ion generator which produces air ions without detectable by-products. An improvement of importance introduced in the arrangement of the aspiration ion counter is that the electrostatic electrometer used in the earlier devices is replaced by an electronic electrometer unit with a following electronic amplifier connected to a commercial recorder for recording the ion current. Variations in the ionic density of long time periods are always observed, and the task to adapt instruments for the investigation of the density fluctuations of air ions is indicated. Various methods for measuring the mobility of air ions are discussed, including the impulse method by which air is sucked into a chamber with two electrodes and a potential difference is applied to the electrodes.
APTIC-22803

### DEVELOPMENTAL WORK ON THE ANDERSEN SAMPLER.

Dugway Proving Ground, Utah, Aerosol
Technology Branch, Project Order 0015, RR 108,
79p., Nov. 13, 1956. 11 refs.
Ariel A. Andersen.
Identifiers: *Microorganisms, *Samplers, Aerosols, Operating variables, Particle size, Sieve analysis, Cascade samplers, Impingers, Design criteria.

The design, construction, and operation is described of a six-stage cascading sieve aerosol sampler that collects viable airborne particles, discriminates them into several groups of decreasing particle size, and deposits them directly upon a nutrient medium for enumeration. The unit consists essentially of a series of similar stages through which the aerosol sample is drawn; each stage contains a Petri dish of solid culture medium upon which the particles are collected by direct impingement. The sampler is fitted with a millipore filter unit. Counting techniques are given. There is no slippage of particles, and wall loss is low; sensitivity and accuracy are high. Particle counts of fine particle bacterial aerosols obtained with the sampler were consistently higher than cell counts obtained with the all-glass impinger. Improved counting techniques and the use of an aerosol diluter are being tested to overcome the limited capacity of the sampler with high concentration aerosols. Applications include establishing the relationship between the particle size spectrum of an aerosol and the amount of infection it produces in exposed animals and the study of viable and physical decay rates. The sampler may also prove of value in studies of air pollution by dust, smog, smoke, fungus spores, and pollen. A brief description is given of a cold weather sampling unit which operates satisfactorily below minus 20 C.
APTIC-22804

### LITERATURE REVIEW OF METROPOLITAN AIR POLLUTANT CONCENTRATIONS--PREPARATION, SAMPLING AND ASSAY OF SYNTHETIC ATMOSPHERES. (FINAL REPORT).

Stanford Research Inst., Menlo Park, Calif.,
Contract DA 18-064-404-CML-123, S.R.I. Proj.
SU-1816, 193p., Nov. 30, 1956. 82 refs
H. C. Wohlers, and G. B. Bell.
Identifiers: *Controlled atmospheres, *Analytical methods, Urban areas, Automotive emissions, Stack gases, Bacteria, Particulates, Coal, Natural gas, Fuel oils, Electric power production, Incineration, Primary metallurgical processing, Dust fall, Electrochemical methods, Iodimetric methods, Saltzman method, Spectrophotometry, Hi-vol samplers, Impingers, Membrane filters, Glass fabric, Ultraviolet spectrometry, Hydrofluoric acid, Formaldehydes, Ammonia, Fluorides, Chlorine, Fluorine, Hydrocarbons, Carbon dioxide, Carbon monoxide, Nitrogen dioxide (no2), Sulfur dioxide, Ozone, Hydrogen sulfide.

A literature review of metropolitan air pollutant concentrations and of the preparation, sampling, and assay of synthetic atmospheres is presented. Measured concentrations of gaseous and particulate pollutants in the atmosphere, including sulfur dioxide, hydrogen sulfide, nitrogen dioxide, ammonia, formaldehyde, hydrocarbons, chloride, carbon monoxide, ozone, fluoride, hydrogen fluoride, carbon dioxide, gross particulates, and dust fall are tabulated. Calculated emissions from centers of population are presented for industrial and public processes, including combustion of coal, oil, and natural gas, incinerators, automobile exhausts, power plants, and metallurgical operations. Data on measured and calculated air pollution concentrations throughout the world are given. Methods for injecting pollution simulants into a test chamber, such as ozone generators and aerosol despensers, are mentioned. Sampling and analytical procedures are described for the particular problem of testing static atmospheres for bacteria. Sampling equipment consists primarily of an impinger preceded by a millipore filter. Analytical procedures include ultraviolet absorption, high volume sampling, glass fiber filters, and colorimetric, gravimetric, iodimetric, spectrophotometric, Saltzman, and electrochemical methods.
APTIC-22812

### A NEUTRAL AND ION MASS SPECTROMETER FOR ENVIRONMENTAL GAS COMPOSITION OF THE APOLLO TELESCOPE MOUNT. EXPERIMENT NO. T-030. (FINAL REPORT).

Michigan Univ. Ann Arbor, High Altitude
Engineering Lab., Contract NAS 8-21448, Rept.
01747-1-F, 38p., Dec. 1969. CFSTI: N70-22573
Richard J. Leite, Conrad J. Mason, Barry B.
Hinton, and Roland D. Kistler.
Identifiers: *Spacecraft atmospheres, *Experimental equipment, *Mass spectrometry, Design criteria.

The artificial atmosphere in the neighborhood of a spacecraft consists of gaseous and particulate constituents which originated on or within the spacecraft itself. These constituents, being foreign to the ambient atmosphere, are considered to be contaminates which alter the local atmospheric composition and therefore must be defined before using the spacecraft as a platform for in situ or remote sensing experiments. The contaminates are expelled from the spacecraft by several mechanisms, such as, leaks, outgassing, scouring of surface deposits by impact of atmospheric particles resulting from the translational motion of the spacecraft, waste elimination and rocket exhausts and therefore may have concentrated or diffusive origins. The present work is part of an effort to determine the composition and distribution of the gaseous contaminates within this artificial atmosphere. A neutral particle and positive ion mass spectrometer developed for use on the Apollo Telescope Mount (ATM) is described. A mass range of 100 atomic mass units is swept exponentially in approximately 12.5 seconds. The 0 to 5 volt analog output signal is produced by a logarithmic electrometer. The electronic components are entirely solid-state devices. A description of the accompanying ground support equipment and a set of operating instructions are included. Recommendations related directly to the ATM operations and requirements, including environmental test operations, are given. (Author abstract)
APTIC-22865

### KEEPING THE AIR PURE.

(Reinhaltung der Luft). 58p., 1968. 25 refs.
Translated from German Belov and Associates,
Denver, Colo., 80p., Feb. 5, 1970.
Personal Author Not Recorded.
Identifiers: *Measurement methods, *Plume behavior, Germany, Stack gases, Dusts, Smokes, Stacks, Dust fall, Smoke shade, Gas chromatography, Saltzman method, West and gaeke, Spectrophotometry, Continuous monitoring, Konimeters, Gas sampling, Particulate sampling, Impingers, Membrane filters, Stack sampling, Absorption (general), Infrared spectrometry, Diffusion, Winds, Turbulence (atmospheric), Hydrochloric acid, Nitric acid, Chlorine, Fluorine, Hydrocarbons, Carbon dioxide, Carbon monoxide, Nitric oxide (no), Sulfur dioxide, Sulfur trioxide, Hydrogen sulfide.

A review of technical articles relating to air pollution is presented. Sampling techniques and statistical evaluation of results are discussed. The effects of gaseous impurities on humans and plants are briefly mentioned. Maximum emission values for nitric oxide, nitric acid, chlorine, hydrogen chloride, hydrogen sulfide, and sulfur dioxide are tabulated. Measurement methods, including filters, absorption bottles, and various continuous methods are described. SO2 is generally measured by the silica gel method, the West Gaeke method, the 'Ultragas 3' method, the Pico-flex instrument, or by infrared spectrophotometry. Isopropanol is a good absorption medium for sulfur trioxide. Dewpoint measurement and detectors are mentioned. NO2 can be measured by the Saltzman method, and by photometric or colorimetric means. Measurement of H2S and fluorine emissions may be done by the sodium hydroxide method. Methods for carbon monoxide and dioxide are mentioned. Organic compounds are measured by gas chromatography. Methods for measuring and counting dust contaminants, and stack sampling are discussed. Optical and electrostatic methods of determining smoke shade are described. The Konimeter, impinger, and dust fall methods are considered. A disucssion of plume behavior, including stack height, turbulence, diffusion, and winds, is presented. Several laws regarding emissions are mentioned.
APTIC-22877

### REPORT ON THE 'UNIVERSAL' AIR POLLUTANT ANALYZER.

Washington State Univ., Pullman, Inst. of
Technology, P.H.S Contract 66512, 37p., Sept. 4,
1957. 26 refs.
D. F. Adams, H. J. Dana, and R. K. Koppe.
Identifiers: *Colorimetry, *Continuous monitoring, *Intermittent monitoring, Analytical methods, Spectrophotometry, Measurement methods, Automatic methods, Sampling methods, Field tests, Instrumentation, Fluorides, Sulfur dioxide, Ultraviolet radiation, Visible radiation, Flow rates, Temperature.

The development, design, and construction is described of a basically versatile automatic instrument system potentially applicable to the sampling, analysis, and recording of levels of any atmospheric pollutant for which colorimetric methods are available or can be devised. Conditions which may be easily varied include air sampling rate, reagent, light wave band from short ultraviolet through the visible range, reagent flow rate, temperature of the air-reagent contactor system, and optical system. The design is suitable for producing dosimeter or continuously integrated records; a prototype analyzer was constructed for each recording method, although the instrument is basically intended as a dosimeter, based on the varying time span necessary to accumulate equivalent pollutant concentrations. The Zirconium-Eriochrome Cyanine R reagent for fluoride and the Starch-Iodine Blue reagent for sulfur dioxide were modified for use in the analyzers. The reduced stability of these reagents under continuous air aeration for periods exceeding 4-12 hrs limits the pollutant concentration which may be accumulated by a single reagent charge. This appears, however, to be desirable from the viewpoint of field application. In field testing, simultaneous comparisons were made with commercially available instruments for sulfur dioxide and hydrogen sulfide. The dosimeter

showed greater sensitivity of these two pollutants than the other instrumental methods. Recommendations are included for further research/study in seven areas to improve the accuracy, versatility, and reliability of the system and to reduce its cost.
APTIC-22879

### SAMPLING DUST IN THE BUREAU OF MINES COAL-FIRED GAS TURBINE.

Combustion, 35 (4):28-30, Oct. 1963.
A. S. Moore.
Identifiers: *Combustion gases, *Dusts, *Sampling probes, Coal, Furnaces, Gas turbines, Particle size, Source sampling, Filters, Design criteria, Experimental equipment, Field tests, Flow rates.

An apparatus is described for sampling dust at the inlet of an experimental turbine that uses combustion gases from a coal-fired furnace. Erosion of turbine blades by dust entrained in the gases was a major difficulty, and accurate dust sampling was required to test the effectiveness of redesigned blades and gas path. The probe is a 1/2-in. I.D., type 316 stainless steel tube carrying a 1/2-in. I.D. sampling nozzle and leading to an external filter. It is coupled to a pitot-static tube, with both probe and tube protected by water jackets. Measurements will be made to determine total dust load, particle size, incidence and degree of particle segregation, and gas velocity. Gas velocities through the probe are maintained automatically at the isokinetic sampling rate by an air operated valve; temperature of the gas at the filter is maintained at 220-240 F. Methods and results are given of testing on a half-scale mock-up of the turbine inlet to insure the requisite continuous-operation 1500-hr capability of the system. The filter retained more than 99% of the dust; variation in gas sampling rates at the probe face was approximately plus or minus 1.5%. The system removed a sample representative by weight with an average deviation of plus or minus 6.4%, and was judged adequate in all respects.
APTIC-22882

### SIGNIFICANCE OF ERRORS IN STACK SAMPLING MEASUREMENTS.

Preprint, Air Pollution Control Association, New York City, 27p., 1970. 6 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 63rd, St. Louis, Mo., June 14-19, 1970, Paper 70-35.)
R. T. Shigehara, W. F. Todd, and W. S. Smith.
Identifiers: *Errors, *Sampling probes, *Stack sampling, Stack gases, Flow rates.

Many separate measurements are made in order to determine the average pollutant emission rate over the sampling period. For example, temperature, pressure, gas composition including moisture content, velocity heads, and metering device adjustments are all necessary in order to accurately attain isokinetic sampling conditions. The stack sampler is faced with the problem of deciding how accurately he should make these measurements, a decision which directly influences his selection of stack sampling equipment and the sampling methodology. Maximum errors in terms of individual measurements conducted in stack sampling are considered for two specific examples: velocity measurement using the pitot tube, and a sampling train utilizing a pitot tube and an orifice meter to attain isokinetic conditions. By partial differentiation of the pitot tube equation and the isokinetic sampling train equation, the relative order of magnitude of errors are determined. For the example of measuring velocity using the pitot tube, the greatest source of error is the velocity head measurement; for the isokinetic sampling train equation, the greatest sources of error are the measurements of the velocity head, moisture content of the stack gas, and the nozzle diameter of the sampling train. (Author abstract modified)
APTIC-23351

### AUTOMATIC EQUIPMENT FOR THE DETERMINATION OF TRACE AMOUNTS OF HYDROCARBONS IN AIR AND OXYGEN.

(Ein automatisches Geraet zur Bestimmung von Kohlenwasserstoffspuren in Luft und Sauerstoff). Text in German. Chem. Tech. (Berlin), 20 (8):484-488, Aug. 1968. 5 refs.
Jutta Theer.
Identifiers: *Gas chromatography, *Trace analysis, *Automatic methods, *Hydrocarbons, Germany, Air quality measurements, Chromatography, Continuous monitoring, Acetylenes, Oxygen, Gases.

It was possible to make quantitative determinations of trace amounts of hydrocarbons in the air and in oxygen by using a GBC 1 Model Process-Gas Chromatograph and a few accessories. The detection limits were between 0.003 and 0.005 ppm. It was possible to continuously monitor acetylene concentrations at every measuring point of an air analysis plant, without resorting to enrichment and within a very short analysis time (maximum of 10 minutes).
APTIC-23365

### THE ATMOSPHERIC DIAGNOSTICS PROGRAM AT BROOKHAVEN NATIONAL LABORATORY: SECOND STATUS REPORT.

42p., Nov. 1969. 17 refs. CFSTI: BNL 50206
Personal Author Not Recorded.
Identifiers: *Tracers, *Sulfur oxides, *Isotopes, Electric power production, Mass spectrometry, Ground level, Lower atmosphere, Plume behavior, Sulfur compounds, Combustion.

The Isotope Ratio Tracer Method provides a means of unambiguously tracing sulfur in the atmosphere. It is specific, and the tracer behaves exactly like the pollutant sulfur, since it makes use of sulfur already in a fuel. The method is nonradioactive and applicable to a wide range of problems. Each of the elements necessary for its implementation has been developed and is in routine operation. This includes means of efficiently collecting samples that are adequate in size and representative of both sulfur dioxide and sulfur trioxide from furnace systems and sulfur dioxide and sulfates from the air at ground level and aloft; methods and apparatus for quantitatively processing small samples in preparation for isotope mass measurements; and design, procurement, and operation of an isotope ratio mass spectrometer with high sensitivity. Techniques for using SF6 as a collateral tracer have also been developed. The IRT method can be applied both to problems in the physical tracing of sulfur, such as in stack plumes, and to studies of the chemistry of sulfur oxides in the atmosphere. Results are reported on investigations currently underway, including combustion studies in power plants, plume dispersion from tall stacks, and pollution patterns in a small city. (Author abstract modified)
APTIC-23377

### MEASUREMENT OF DUST FALL AND MEASURING INSTRUMENTS.

Kogai to Taisaku (J. Pollution Control), 5 (10):777-784, Oct. 10, 1969. 5 refs. Translated from Japanese. 22p.
Motoji Terabe.
Identifiers: *Dust fall, *Particulate classifiers, *Samplers, Japan, Settling particles, Suspended particulates, Hi-vol samplers.

Instructions are given for measuring (1) dust density by the gravimetric or relative density method; (2) dust fall by the dust jar method; (3) relative density of suspended dust with a tape sampler; (4) weight density of suspended dust with a high-volume sampler, and (5) distribution of particulate sizes with the Andersen sampler. Also presented are the results of measurements of airborne particulates made with a high-volume sampler, a high-volume sampler with cyclone, a tape sampler, and a digital dust meter. The various samplers are compared with respect to the ratio of measured values.
APTIC-23387

### A METHOD FOR DETERMINING THE PARTICLE SIZE OF AIRBORNE DUST.

Mound Lab., Miamisburg, Ohio, AEC Contract At-33-1-Gen-53, 8p., June 1, 1969. 2 refs. CFSTI: MLM-1596
C. T. Meyer, H. F. Anderson, and J. B. Kahle.
Identifiers: *Electron microscopy, *Dusts, *Particle size.

Electron microscopy techniques were applied to a survey of particle size distribution of airborne dusts. The dust particles were collected on a membrane filter, then transferred to a Formvar-covered electron microscope grid by placing a small piece of the filter on a stainless steel screen, supporting the grid, and dissolving it in an ethyl acetate bath. Particle sizes were determined by comparing electron micrographs of the dust particles with micrographs of polystyrene spheres taken at the same magnification. Electron micrographs of three different air samples are shown at magnifications of 6000, 12,000, and 30,000 X, respectively. The majority of particles in the micrographs are on the order of 0.5 micron.
APTIC-23394

### ELECTRONIC RECORDING BLOWBY METER.

Preprint, Society of Automotive Engineers, Inc., New York, 15p., 1969. 7 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Chicago, Ill., May 19-23, 1969, Paper 690475.)
Bob Mayernick, and William R. Clark.
Identifiers: *Blowby, *Potentiometric methods, *Recording methods, Internal combustion engines, Measurement methods, Automatic methods, Design criteria, Dynamometers, Flow rates, Pressure.

An electronic, automatic, recording blowby meter (RBM) for internal combustion engines is described. Details are given of the three main systems comprising the meter: gas flow (engine, full-flow filter, laminar flow unit, and thermocouple); pressure-to-electric-signal conversion (differential pressure transducer, power supply, voltage divider, and bridge balance); and potentiometric recorder (chart recorder, integrator, and counter). A definite correlation was found between blowby flow rate and crankcase pressure, though some non-linearity exists below 6 cfm flow rate. Patterns of blowby during various operating conditions are illustrated. The meter can measure both dynamic and static blowby conditions, and displays on graph paper a permanent record of engine blowby. The RBM is capable of finding malfunctions of its own and other operational systems. Though designed basically for dynamometer laboratory use, it has some degree of portability.
APTIC-23401

### GAS ANALYSIS BY POLYMER CHAIN SCISSION OZONOLYSIS OF POLYSTYRENE.

Environ. Sci. Technol., vol. 1:658-660, Aug. 1967. 5 refs.
H. H. G. Jellinek, and F. J. Kryman.
Identifiers: *Chemical methods, *Styrenes, *Ozone, Synthetic rubber, Analytical methods, Oxidation, Reaction kinetics, Thermodynamics.

The feasibility of using chain rupture for analyzing minute amounts of gases which react with polymer molecules to create chain scission was investigated in the case of ozone and polystyrene. In the experiments, dry ozonized air was passed from an ozonator to an evacuated reaction vessel until gas pressure was about 1 atm. The gas was then swept out of the vessel with dry air and passed through a KI solution to determine the total amount of ozone. Next the reaction flask was filled again with ozonized air and polystyrene solution in carbon tetrachloride was added. The intrinsic viscosity was determined as a function of time and temperature. The activation energy of the random chain scission was calculated as 28.5 kcal per mol. The ozone was completely used up after reacting for 48 hr with the polymer at 25 C. Under

prevailing conditions, the sensitivity of the method is about 20 ppm. It can most likely be increased to 0.02 ppm, and experiments to this effect are in progress, as are experiments intended to shorten the reaction time and make the apparatus more convenient to handle.
APTIC-23415

### AUTOMATED DETERMINATION OF MERCAPTANS IN AIR.

Advan. Automated Anal., 1970:107-110. 2 refs.
(Presented at the Technicon International Congress, Chicago, Ill., June 4-6, 1969.)
R. N. Heistand.
Identifiers: *Colorimetry, *Continuous monitoring, *Mercaptans, Automatic methods.

An automated method is described for detecting levels of alkyl mercaptans lower than their odor threshold. Air is drawn through a Technicon AutoAnalyzer air sampler at 1.9 ml/min, and mercuric acetate absorber solution is pumped through the air absorber column at the rate of 0.23 ml/min. This solution collects in the air-liquid separator until the valve in the valve-timer system admits it to the manifold. The flow through the valve-timer is 1.2 ml/min. During the full 30-min cycle of the valve-timer system, absorber solution is pumped for only 5 min. Distilled water is pumped during the remaining 25 min of the cycle. The final stripchart record is a continuous baseline interrupted by 5-min peaks representing 1/2-hr average RSH concentrations. The flow from the valve-timer is then air-segmented, diluted, and reacted with diamine in the presence of ferric ion. A red dye forms when mercaptans are present. After a short delay to allow the reaction to approach completion, the solution is debubbled and passed through a 50 mm flowcell where absorbance is measured at 480 millimicrons. As experimentally determined, the method is quite selective and its sensitivity is adequate for routine atmospheric monitoring.
APTIC-23419

### STEREOPHOTOGRAMMETRIC PHOTOGRAPHY OF SMOKE STREAMS.

(Opyt stereofotogrammetricheskoy s'yemki dymovykh struy). Text in Russian. Soobshch. Akad. Nauk Gruz. SSR, 52 (2):341-344, 1968. 2 refs.
A. G. Balabuyev, and R. I. Gerasimov.
Identifiers: *Photometric methods, *Plume behavior, Ussr, Smokes, Photographic methods.

The feasibility of synchronous stereophotogrammetric ground based photography of smoke streams was demonstrated and yielded very useful numerical characteristics of basic parameters of the streams. These characteristics can be further supplemented and extended through combination with synchronous motion picture photography. It is anticipated that more complete data for determining diffusion coefficients will be possible if measurements are made of particle concentrations at various points in the stream, of horizontal and vertical wind velocity components both within and outside of the stream, and of stream temperature values at the time photographs are taken. Samples of stereo pairs taken near Tbilisi in 1966 and 1967 are presented and analyzed.
APTIC-23427

### GRAPHIC CAM PROGRAMMER IS EASILY CHANGED.

Control Eng., 10 (7):131, July 1963.
C. L. Dozois, R. W. Hurn, and R. L. Mills.
Identifiers: *Engine exhausts, *Computer programs, *Dynamometers, Operating variables, Test engines.

One phase of research on the air pollution effects of auto exhaust requires a closely regulated, continuous supply of exhaust gas resembling that emitted from an auto during typical city traffic conditions. To achieve this intricate pattern of almost constantly changing speed and load combinations in an engine dynamometer installation, three program generation and follow-up channels provide position orders to the throttle of the test engine, to the dynamometer rheostat, and to the throttle of the motoring engine. The heart of each control channel is a programmer that translates the radial contour of a 360 deg graphic cam into a dc level. Three graphic cams, driven by a single motor for synchronization, are easily drawn film positives that can be readily altered by blacking in additional area or removing some of the opaque portion, or they can be replaced completely in a few minutes. Operation with the graphic cam is described.
APTIC-23431

### MEASUREMENT OF SOOT.

(Sottalsmatning). Text in Swedish. VVS (J. Assoc. Heating, Ventilation, Sanit. Engrs.) (Stockholm), 60 (11): 597-606, Nov. 1969.
Folke Peterson.
Identifiers: *Soot, *Fuel oils, *Bacharach number, Sweden, Incineration, Measurement methods, Solids.

The Bacharach number is an indirect determination of the content of solids in fuel oil. For heavy fuel oils, no direct correlation exists between Bacharach number and solid content. For solid fuels or waste incineration, the correlation is even less distinct, and the Bacharach number is not useful. The errors involved in a correctly determined Bacharach number are slight. A 5% change in the volume of flue gas will not normally influence the number.
APTIC-23437

### THE MEASUREMENT OF SOLIDS IN FLUE GASES.

For primary bibliographic entry see Field 01.
APTIC-23441

### GASEOUS CHLORIDE IN THE ATMOSPHERE.

Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 2 (1):96-98, 1967. Translated from Japanese. 10p.
Toshiichi Okita, and Seigo Nakahara.
Identifiers: *Air quality measurements, *Gas sampling, *Hydrochloric acid, Japan, Flow rates, Chlorides, Particulates, Glass fabrics.

An experiment was performed to verify the presence of gaseous chloride in the atmosphere. Two glass fiber filters were washed with distilled water and one was soaked in a 5N solution of sodium hydroxide. The filters were connected in series to an air sampling system with the basic filter downstream from the neutral filter with respect to the source of air. Air was drawn through the filters at a rate of 10 l/min for 2 hours. Chlorine was determined by the mercuric thiocynate method. Particulate Cl collected in the first filter ranged from 25 to 35 microgram/ cu m. Gaseous Cl (HCl) precipitated in the second filter ranged from 10 to 23 microgram/cu m. The concentration of gaseous Cl was 1/3 to 1/2 that of particulate Cl.
APTIC-23451

### INVESTIGATION OF CORRELATION AMONG VARIOUS INDEXES OF AIR POLLUTION.

Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 2 (1):96-98, 1967. Translated from Japanese. 10p.
Heihachiro Yazawa, and Sachihiro Mizugami.
Identifiers: *Particulates, *Measurement methods, *Sulfur dioxide, Manual, Japan, Soiling index, Chemical methods, West and gaeke, Automatic methods, Photometric methods, Hi-vol samplers.

Concentrations of sulfur dioxide and particulates have been employed as indexes of the level of air pollution and for environmental standards. Various methods have been proposed for the measurement of these concentrations. The correlation among values measured by different methods from the data obtained at four stations in Sappora was investigated. Concentrations of SO2 were measured using the Thomas and West Gaeke methods. Airborne particulates were sampled by a tape air sampler, and particulate density on the filter was measured by the following three different procedures: automatic measurement using light transmission; manual measurement using light transmission; and manual measurement using light reflection. The weight concentration of particulates sampled using a high-volume air sampler also served for comparison. The correlation of weight concentrations of particulates and readings of dust density on the filter tape was extremely low. The values of correlation between the soiling indexes measured by the first two procedures were different at different sampling sites. The difference of readings of soiling index between individual automatic recorders was considerable. Fairly close correlation was observed between SO2 concentrations measured by the Thomas and West Gaeke methods. Although the mean concentration by the West Gaeke method was lower than that by the Thomas method, it seemed that mutual conversion of the values between the two methods was possible to some extent. Although the above correlation was dependent on the environmental conditions in situ, it provides a means for evaluating the level of air pollution.
APTIC-23452

### EVALUATION OF THE ERROR OF MEASUREMENT DUE TO ANISOKINETIC SAMPLING IN THE DETERMINATION OF DUST CONTENT IN FLOWING GASES.

(Bestimmung des Messfehlers durch nichtisokinetische Teiletromentnahme bei der Ermittlung des Staubgehaltes in stroemenden Gasen). Text in German. Tech. Ueberwach. (Duesseldorf), 9 (2):51-52, Feb. 1968. 12 refs.
Peter Zenker.
Identifiers: *Isokinetic sampling, *Error evaluation, *Dusts, Germany, Sampling methods, Statistical analyses.

A new diagrammatic method is described which enables evaluation of error in dust content measurement caused by anisokinetic sampling of the flowing gas. The characteristic material quantity l is defined as a parameter which is a measure of kinetic energy of dust particles. The theoretical considerations lead to limiting curves, which hold for very fine and very coarse dust particles. The intermediate values of the parameter 'l' for the diagram were determined from statistically processed measurements of other authors. Contrary to generally prevailing opinion, the 10% deviations from isokinetic air sampling do considerably influence the result of dust concentration measurement. The measurements confirming this conclusion are planned.
APTIC-23461

### ON THE DETERMINATION AND OCCURRENCE OF LOW CONCENTRATIONS OF NITROUS OXIDE IN EXHAUST GASES AIR AND WATERS.

Ueber die Bestimmung und das Vorkommen niedriger Konzentrationen von Distickstoffoxid in Abgasen in der Luft und in Waessern). Text in German. Allgem. Prak. Chem. (Vienna), 19 (3):78-79, 1968. 7 refs.
Wolfgang Leithe, and Andreas Hofer.
Identifiers: *Chromatography, *Nitrous oxide (n2o), Europe, Nitrous oxide (n20), Gases, Water.

A method of gas-liquid chromatography using separation columns based on propylene carbonate-glutaronitrile on 'stercham' was developed. Using a hot-wire detector, the method enabled easy detection and determination of 50 ppm nitrous oxide in a 10 ml gas sample. For measurement of still lower N20 concentrations, an enrichment column filled with activated silica gel and immersed in cooling mixture of -70 to -75 deg was employed. The concentration of .23 ppm N20 was thus determined. The experimental set-ups for both the chro-

matography and enrichment process are described. For determination of N2O content in water, a simple method is proposed, according to which the gases are boiled off from the liquid and lead into an enrichment apparatus. The air is then frozen out and N2O with He as a carrier gas is passed into the separation column.
APTIC-23462

### ESTIMATION OF THE BREAKDOWN POSSIBILITIES OF THE OUTDOOR HIGH VOLTAGE INSULATORS BY THE MEASUREMENT OF THE PROPERTIES OF POLLUTION.

For primary bibliographic entry see Field 09.
APTIC-23463

### COUNTERFLOW JET TOTAL PRESSURE PROBE.

Preprint, Illinois Univ., Chicago, 7p., May 8, 1969.
CFSTI: PB 188336
Gary Francis Morr.
Identifiers: *Sampling probes, *Design criteria, *Stack sampling, Suspended particulates, Particle size, Flow rates, Density, Pressure.

The counterflow jet total pressure probe is a device for the precise measurement of the total pressure of a flowing gas when the gas is either laden with suspended solid particles or flowing in an entirely gaseous state. From measurements made with the probe, the gaseous velocity can be accurately determined for a range of velocities, particle sizes, and particle cloud densities which are found in industrial and laboratory conditions. The identifying design feature of the probe is a small, shrouded tube or orifice through which a jet of gas is discharged in counterflow to the stream whose velocity is to be measured. The theory of operation and design characteristics of the probe are described, and a drawing of the apparatus is given.
APTIC-23464

### MATHEMATICAL MODELS FOR PREDICTION OF FUEL TANK AND CARBURETOR EVAPORATION LOSSES.

Preprint, Society of Automotive Engineers, Inc.,
New York, 31p., 1969. 9 refs. (Presented at the
Society of Automotive Engineers, Mid-Year
Meeting, Chicago, May 19-23, 1969, Paper
690506.)
W. J. Koehl Jr.
Identifiers: *Fuel tank evaporation, *Carburetor evaporation losses, *Mathematical modeling, Automobiles, Computer programs.

A comprehensive method for predicting the mass and composition of evaporative losses from fuel tanks and carburetors, and a computer program embodying the method are presented. The method is presented as a tool to assist in the design and evaluation of fuels and vehicle evaporation control systems; it is not intended as a substitute for compliance testing. The prediction method makes use of published equations for carburetor loss, tank loss, and loss composition. Calculated losses are compared with measured losses from several published studies. The accuracy and the limitations of the method are described, and some relationships between losses and fuel and fuel system parameters are shown. (Author abstract modified)
APTIC-23465

### METHOD OF DETERMINING THE COMPOSITION OF EXHAUST GASES, FROM 'OTTO' CYCLE ENGINES.

(Metodo per la determinazione della
composizione dei gas di scarico dei motori a ciclo
'Otto'). Text in Italian. Termotecnica (Milan), 21
(11):603-608, Nov. 1967. (Presented at the ATI
National Congress, 12th, Rome, Italy, Sept. 27-29,
1967.)
Enzo Bellomo, and Giorgio Martinelli.
Identifiers: *Automotive emissions, *Measurement methods, Italy, Catalytic afterburners, Automotive emission control, Air-fuel ratio, Carburetion, Engine design modification.

Most poisonous elements in the exhausts from internal combustion engines are carbon monoxide and the concentration of hydrocarbons (CnHm). Both depend primarily on imperfect combustion. Reduction of CO and CnHm content can be achieved by: increase in air temperature before combustion, optimum air/fuel ratio, adjustment of carburetor and ignition, decrease in cylinder displacement, higher combustion temperature, accurate valve setting and devices on mufflers and exhaust pipes. Three methods of inspection are examined: a) Dynamometer test; while the vehicle is running exhausts are continuously tested through industrial analysers. The test has two cycles each with a number of programmed steps. One cycle starts with the engine cold, the other with the engine warmed up. b) Long range testing while the vehicle is driven for 50,000 miles. c) Testing with the engine running at idle. An analysing system is examined in its components. Steps for calibrating the system are outlined. During dynamometer testing another type of analyser is used: it is called URAS and it functions on the principle of different absorption of gaseous components on the infrared spectrum. A portable CO analyser is described. The plantinum leg of a balanced Wheatstone bridge is introduced in a chamber containing CO and H2. Both CO and H burn due to the catalytic action of the platinum wire. The resistance changes and a relation can be established, between this change and the content of CO and CnHm.
APTIC-23473

### MEASUREMENTS OF SMOKE AND DUST DENSITY BY THE EXTINCTION PRINCIPLE.

(Rauch- und Staubdichtemessungen nach dem
Extinktionsprinzip). Text in German.
Elektrizitaetswirtschaft, 65 (24):740-743, 1966.
Guenter Schmidt.
Identifiers: *Dusts, *Smokes, *Photometric methods, *Photoelectric phenomena, Germany, Calibration methods, Design criteria, Density.

Instruments operating on the electronoptic principle are the preferred means of measuring smoke and dust density. A measuring device operating on the photoelectric extinction principle is described, with reference to the geometric configuration of light rays, the mathematical background of the signal circuit, and the relationship of observed values to actual dust content. The apparatus divides the light coming from the source into 2 beams: the measuring beam, and the comparison beam. Included are a diagram of the signal circuit, a discussion of the calibration (logarithmic), the electronic component, measurement procedures, the DC motor used to operate the equipment, and the choice of measuring points.
APTIC-23483

### OIL-CONSUMPTION MEASUREMENTS OF INDIVIDUAL CYLINDERS IN AUTOMOTIVE ENGINES.

Preprint, Society of Automotive Engineers, Inc.,
New York, 7p., 1970. 2 refs. (Presented at the
Automotive Engineering Congress, Detroit,
Mich., Jan. 12-16, 1970, Paper 700055.)
W. J. Mayer, D. P. Krause, C. P. Moore, and C. B.
Murphy.
Identifiers: *Oil consumption, *Measurement methods, *Bromides, Engine exhausts, Internal combustion engines, Trace analysis, Radiation measuring systems, Bromine compounds, Isotopes, Radioactive radiation.

Oil consumption was measured for the individual cylinders of a multicylinder automotive engine. The method employed bromine-82 as the indicating isotope and consisted of the extraction of radioactive hydrogen bromide from a known fraction of cylinder exhaust gas. The precision of the method is plus or minus 10%. Oil consumption was measured for the individual cylinders over a speed range 1200-2800 rpm and a load range 18-6 in. intake manifold depression. The oil consumption of the engine determined by the summation of the oil consumption of the individual cylinders agreed reasonably well with the oil consumption measured on the overall engine. Variation in oil consumption between cylinders in the particular engine used was surprisingly large-in some instances a factor of three. Oil-consumption measurements were extended to each bank of the engine as well as the overall engine by the extraction of the radioactive hydrogen bromide from a known fraction of their respective exhausts. From the data obtained on this engine, it is also concluded that oil consumption can be measured in multicylinder engines by the fractional exhaust gas-extraction procedure over a wide speed-intake manifold depression range. Because of the additional measurements and the assumptions necessary, the fractional exhaust gas method is more subject to error than the total-extraction method. (Author abstract modified)
APTIC-23487

### ON THE METHODS OF COUNTING AIR IONS.

Biometeorol. Proc. 3rd Int. Biometeorol. Congr.,
1963, 2 (2):1037-1046. 38 refs. (Sept. 1-7.)
J. Reinet, H. Tammet, and J. Salm.
Identifiers: *Particle counters, *Design criteria, *Ions, Ussr, Electrical measurement devices, Voltage.

Design of a reliable multiple-purpose counter of small size is described, which can easily be handled and used in carrying out research into bio-climatological and geophysical problems as well as those of artificial aeroionization. It is expedient to ground the outer cover of an air ion counter, in which case the neutral terminal of a sensitive electrometer receives a voltate. If the neutral terminal is grounded, the electrometer should be connected with the inner cover by a coupling capacitor. The disturbing influence of voltage fluctuations is removed by a balanced bridge scheme. In the case of a sensitive electrometer, the ionic current may be measured by voltage drops arising on the resistor shunting the electrometer. It is even better to compensate the ion current by the current passing through a high resistance, by maintaining the input voltage of the electrometer in the vicinity of zero. The most essential parts of the structure of a counter are its insulators, which must be protected from the direct action of outside air and the precipitation of aerosol particles. Parts surrounding the insulators must have a voltage equivalent to that of the inner cover. The indicating instrument mounted on the switchboard directly shows the ion concentration. Changes in ion density can be automatically registered by means of a recording external millivoltmeter connected with the alternating current counter. (Author abstract)
APTIC-23491

### DETERMINATION OF ATMOSPHERIC HYDROGEN SULFIDE WITH AUTOMATIC SAMPLERS.

(Schwefelwasserstoff-Bestimmung in Luft mit
automatischer Probenahme). Text in German.
Wasser Luft Betrieb, 12 (9):529-531, Sept. 1968. 9
refs.
Erdwin Lahmann, and Karl-Ernst Prescher.
Identifiers: *Automatic methods, *Photometric methods, *Hydrogen sulfide, Germany, Sampling methods, Nitrogen dioxide (no2), Sulfur dioxide.

A simple photometric method can be used to detect very low concentrations of hydrogen sulfide in the atmosphere, which automates the taking of samples, always the most time-consuming aspect of the whole measuring procedure. The automatic control device is one that is already commercially developed for use in the determination of atmospheric fluorides. This instrument controls the beginning and the duration of sample-taking and and the time interval between samples in a series. The success of the equipment is dependent on the ability of a freshly prepared cadmium hydroxide suspension to retain its absorbing properties for at

least 24 hours. After taking the sample, this suspension must also remain stable for at least 24 hours, and it must be possible to determine the volume of the air sample with sufficient accuracy. Absorption capacity was tested by the use of parallel circuits, one using a freshly prepared cadmium hydroxide suspension, the other a suspension that had been allowed to stand for 24-48 hours. Comparative studies were made of the sensitivity of this system in the determination of sulfur dioxide and nitrogen dioxide, as this relates to the sensitivity of hydrogen sulfide determination. One mg/cu m of sulfur dioxide or nitrogen dioxide was not a sufficient concentration to disturb hydrogen sulfide readings. The photometric method depends on the color reaction of methylene blue.
APTIC-23494

### EVAPORATIVE EMISSION MEASUREMENTS WITH THE SHED - A SECOND PROGRESS REPORT.

Preprint, Society of Automotive Engineers, Inc., New York, 14p., 1969. 5 refs. (Presented at the Society of Automotive Engineers, Mid-Year Meeting, Chicago, Ill., May 19-23, 1969, Paper 690502.)
Stuart W. Martens.
Identifiers: *Shed technique, *Fuel evaporation, Hot soak, Measurement methods, Instrumentation.

Details are given on interior air temperature, during a hot soak leakage, and car background emissions for the Sealed Housing for Evaporative Determinations (SHED) technique for evaporative emissions measurements. Test results show that the increase in hot soak severity imposed by the use of the SHED is less substantial than resulting increases in ambient temperature would predict, but nonetheless must be allowed for in designing test procedures; appropriate modifications are suggested. Despite rapid pressure bleed-downs from leaks, it is confirmed that SHED hydrocarbon concentrations, once established, do not deteriorate significantly with time; however, circumstances are described which could create significant leakage. Evidence is given to show that non-fuel car background emissions of aged cars are low and can be neglected for practical evaporative testing. Auxiliary equipment developed to facilitate evaporative emission testing and application of the SHED technique to engine start-up and soak emissions are described. The technique also shows unique capability when applied to methods of emission control hardware evaluation.
APTIC-23500

### STATUS REPORT.

Wyoming Univ., Laramie, Dept. of Physics, NASA Grant NGR 51-001-020, 23p., 1970. 3 refs. CFSTI: N70-12719
Edgar A. Rinehart.
Identifiers: *Spectrometry, *Gases, Spectometry, Pressure.

According to Harrington's theory of saturated intensity coefficients; the curve of 'Intensity' (spectrometer signal) vs. incident power will have the same shape independent of molecular species or specific transition. This saturation approach was experimentally verified in the present work on microwave spectroscopic analysis of polar gases in gaseous mixtures. The spectrometer signal was a linear function of partial pressure of the absorber over a pressure range above 3.5 mtorr for pure gases. For gases of much higher dilution, the linear range extends to much lower pressures. A straightforward technique, based on slope ratios, was developed for determining concentrations. A less straightforward method, based on signal measurements only, was also devised. Accurate partial pressure measurements of individual components in a gaseous mixture is feasible, but the amount of data which could be made available from measurements on many compounds is too large to collect under manual operation and recording. Operation under control of a small computer is required. Future measurements of the sulfur dioxide content of selected air samples will provide a test of the methods reported for very small quantities of polar constituents of a mixture of gases. Concentrations in the ppm range are easily determined, and the ultimate sensitivity appears to be several ppb.
APTIC-23503

### EVALUATION OF A LASER FOR USE AS A TRANSMISSOMETER CALIBRATOR. (FINAL REPORT).

Environmental Science Services Administration, Sterling, Va., Weather Bureau, Agreement FA-65 WAI-96, Work Unit 450-401-05E, FAA-RD-70-1, 85p., Jan. 1970. 10 refs. CFSTI, DDC: AD 706356
David H. George, and Robert J. McCann.
Identifiers: *Transmissometers, *Calibration methods, *Lasers, Portable, Visibility.

The NBS-type transmissometer cannot at present be calibrated during all weather and visibility conditions. A laser transmissometer can be calibrated during any visibility and weather condition. For this reason, a laser transmissometer system was evaluated as a possible portable transmissometer calibrator. The laser transmissometer was tested by using it to calibrate an NBS-type transmissometer. Visibility measurements from the laser (objectively) calibrated NBS-type system were compared with measurements from an identical system calibrated by the normal (subjective) method. Results indicate that the laser method tends to calibrate the NBS-type transmissometer to yield higher Runway Visual Range values than does the normal method of calibration. Several shortcomings of the system which was evaluated precluded the opportunity to rigorously test and evaluate the laser method of transmissometer calibration. Shortcomings of greatest significance are as follows: frequent laser beam alignment drift resulted from an inaccurate and partially inaccessible beam alignment mechanism; external glass surfaces of the laser source and remote detector housings lacked adequate environmental protection and thus became water covered during periods of fog and rain; water entered the remote detector housing during periods of rain because of inadequate weather-proof seals; and inaccurately matched photo electric detectors introduced an upward bias to system measurements of atmospheric transmittance. From the limited field tests performed, it is concluded that the laser system in its present configuration is not suitable for use as a transmissometer calibrator. The concept of a transmissometer calibrator system employing a laser, does appear to show potential usefulness.
APTIC-23506

### DETERMINATION OF TRACES OF SULFUR, FLUORINE, AND BORON IN ORGANIC MATERIALS BY OXYGEN BOMB COMBUSTION.

Anal. Chem., 33 (12):1760-1762, Nov. 1961. 12 refs. (Presented at the conference on Analytical Chemistry and Applied Spectroscopy, Pittsburgh, Pa., Feb. 1961.)
J. J. Bailey, and D. G. Gehring.
Identifiers: *Oxygen colorimeter, *Trace analysis, Chemical methods, Electrochemical methods, Spectrophotometry, Fluorine compounds, Boron compounds, Sulfur compounds, Decomposition, Combustion.

A platinum-lined Parr oxygen calorimeter bomb was successfully employed for quantitative decomposition of organic samples. Water is introduced into the bomb prior to combustion and the resulting combustion products are absorbed in the water. This aqueous liquid may then be analyzed for trace quantities of the desired cation (anion) by standard microanalytical methods. The technique permits the combustion of a much larger sample (one gram) than the oxygen flask method. Results of trace analyses of synthetic fluoride, boron, and sulfur samples are presented in tabular form. Exceptionally good results were obtained for sulfur.
APTIC-23517

### ION-EXCHANGE METHOD FOR DETERMINATION OF FLUORIDE IN POTABLE WATERS.

Anal. Chem., 36 (3):577-579, March 1964. 6 refs.
Foymae S. Kelso, John M. Matthews, and Harry P. Kramer.
Identifiers: *Fluorides, *Ion-exchange, *Column chromatography, *Spectrophotometry, Water pollution.

A simple, accurate, and rapid ion-exchange method is described for removing interferences from waters containing low concentrations of fluorides. The method is based on the adsorption of fluoride in an acetate resin slurry, formation of a beryllium-fluoride complex, and removal of the adsorbed fluoride by a beryllium-eluting solution. With this technique, 20-30 water analyses a day can be performed with a precision and accuracy of plus or minus 0.1 mg/l. Thus the results obtained by the method are comparable to those for standard distillation procedures. The saving in time and equipment is considerable.
APTIC-23518

### A NEW FIELD METHOD FOR THE DETERMINATION OF ORGANOLEAD COMPOUNDS IN AIR.

Anal. Chem., 33 (9):1175-1180, Aug. 1961. 3 refs.
Louis J. Snyder, and S. R. Henderson.
Identifiers: *Lead compounds, *Colorimetry, *Scrubbers, Iodine compounds, Tetraethyl lead, Organometallics, Reaction kinetics.

A simplified field method permits the rapid determination of several organolead compounds in air. It is superior to methods previously described for determining tetraethyl lead in air. The method utilizes as a scrubber a small disposable glass tube containing iodine crystals supported by two glass wool plugs. Lead is removed from the scrubber by an acidic potassium iodide solution and is measured by a colorimeteric dithizone method. The scrubber is also effective in collecting some organocompounds of metals other than lead. Data are presented to show relative reaction rates and intermediate products obtained from reacting tetraorganolead compounds with aqueous iodine in conventional scrubbers. (Author abstract)
APTIC-23520

### ANALYZER FOR BLAST FURNACE GAS.

Metallurgist (USSR) (English Translation from Russian of: Metallurg.), no. 6:347, June 1969.
V. A. Pavlenko, M. D. Shutov, V. A. Sankin, and A. O. Sall'.
Identifiers: *Combustion gases, *Automatic methods, *Electroconductivity analyzers, Ussr, Blast furnaces, Potentiometric methods, Hydrogen, Carbon dioxide, Carbon monoxide

The stationary automatically indicating and recording gas analyzer OAO3O6-T was developed for separate measurement of the concentrations of carbon monoxide, carbon dioxide, and hydrogen in blast furnace gas. It comprises optico-acoustic analyzers for CO and CO2, a thermo-conductometric analyzer for H2, and a regulating and filtering unit to prepare the gas mixture for analysis. The thermo-conductometric analyzer for H2 is a compensated comparison circuit composed of a working bridge and the reference bridge. To diminish the influence of a change of CO2 concentration in the gas stream, a bridge is installed in the recorder of the CO2 analyzer which consists of an auxiliary rheostat and a potentiometer. Measuring range is 0-35%, CO, 0-20%, CO2, and 0-10%, H2.
APTIC-23521

### A SIMPLIFIED APPLICATION OF THE ANDERSEN SAMPLER TO THE STUDY OF AIRBORNE FUNGUS PARTICLES.

Preprint, Michigan Univ., Ann Arbor, Section of Allergy, 21p., 1968 (?). 14 refs.
William R. Solomon.
Identifiers: *Fungi, *Cascade samplers, *Design criteria, Particulates.

A detailed description is given of the use of a model 0101 Andersen Sampler in a volumetric study of airborne fungus particles at Ann Arbor begun in 1964, to provide regional data for clinical observations. Although initially the device was used in a conventional manner, it became impractical to process the materials from regular daily collections; a simplified procedure using a single plate of medium below stage 6 to 'telescope' the collection of viable spores was evaluated. The relative ease of processing single S6 plates prompted a comparison of this method with concurrent 'open plate' sampling. Of the several devices developed to collect viable airborne microorganisms volumetrically, the Andersen Sampler appears to be the most practical and aerodynamically sound when modified as necessary for specific research requirements. The data suggest that the present modification, although a radical departure from established procedure, is highly defensible on practical grounds and is quantitatively valid. The major deficiency of the approach is the tendency of a single plate to become overloaded. Total retention of spores by a single plate was not found, although the proportion lost was small. The effects of wind-orienting the sampler are considered, and suggestions to facilitate operation by the method described are given.
APTIC-23535

### TENTATIVE METHOD OF ANALYSIS FOR CHLORIDE CONTENT OF THE ATMOSPHERE (MANUAL METHOD).

22203-01-68T. Health Lab. Sci., 6 (2):61-63, April 1969. 4 refs.
L. V. Cralley, L. V. Haff, A. W. Hook, E. J. Schneider, and J. D. Strauther.
Identifiers: *Colorimetry, *Chlorides, Manual, Particulates, Gas sampling, Particulate sampling, Impingers, Electrostatic precipitators, Filters, Calibration methods, Ions, Gases.

Dissolved chlorides are titrated with a dilute solution of mercuric nitrate in the presence of a mixed diphenylcarbazone-bromphenol blue indicator. The chloride combines with the mercuric ions to form essentially un-ionized $HgCl_2$. When all of the chloride has been titrated, the excess Hg (II) reacts with the indicator to form a blue-violet complex. The procedure is applicable to aqueous solutions containing at least 2 ppm chloride and free of the interferences noted. Gaseous chlorides may be collected by fritted glass absorbers or impingers; particulate chlorides, by filtration, impingement, or electrostatic precipitation. The method will determine 2 ppm chloride in solution with reasonable accuracy; it applies to solutions containing 0.01-12 mg chloride in an appropriate volume, although with modification the limit can be extended indefinitely. Precision is 0.1 ppm or 2% relative, whichever is greater. Only conventional laboratory glassware is required. Reagents, procedure, calculation, and effect of storage are given. The method is termed tentative until it is adopted as standard.
APTIC-23545

### TENTATIVE METHOD OF ANALYSIS FOR FLUORIDE CONTENT OF THE ATMOSPHERE AND PLANT TISSUES (MANUAL METHODS).

12204-01-68T. Health Lab. Sci., 6 (2):64-83, April 1969. 22 refs.
L. V. Cralley, L. V. Haff, A. W. Hook, E. J. Schneider, and J. D. Strauther.
Identifiers: *Analytical methods, *Sampling methods, *Fluorides, Manual, Plants (botany), Column chromatography, Colorimetry, Spectrophotometry, Gas sampling, Particulate sampling, Calibration methods, Diffusion.

General precautions are given when analyzing for fluoride to prevent contamination by extraneous fluoride from such sources as sampling and laboratory apparatus, reagents, and from exposure to laboratory dust and fume. Directions are outlined in detail for sample preparation of particulate fluorides, gaseous fluorides (dry and wet collectors), and vegetation. Five analytical methods are described: isolation of fluoride by Willard-Winter distillation, ion exchange, and diffusion, and fluoride determination by titrimetric and spectrophotometric techniques. For each of these, the principle of the method, range and sensitivity, interferences, precision and accuracy, apparatus, reagents, and laboratory procedure are given, as well as calibration and standards, calculation, and effects of storage. The method is termed tentative until it is adopted as standard.
APTIC-23546

### TENTATIVE METHOD OF ANALYSIS FOR FLUORIDE CONTENT OF THE ATMOSPHERE AND PLANT TISSUES (SEMIAUTOMATED METHOD).

12204-02-68T. Health Lab. Sci., 6 (2):84-101, April 1969. 23 refs.
L. V. Cralley, L. V. Haff, A. W. Hook, E. J. Schneider, and J. D. Strauther.
Identifiers: *Colorimetry, *Fluorides, Plants (botany), Analytical methods, Calibration methods.

A method described for the analysis of fluorides wherein the suspended digest and sulfuric acid are pumped into a Teflon coil of a microdistillation device maintained at 170 C. A stream of air carries the acidified sample rapidly through a coil of Teflon tubing to a fractionation column. The fluoride and water vapor distilled from the sample are swept up the column into a condenser, and the condensate passes into a small collector. The distillate is pumped continuously from the sample collector and is mixed continuously with alizarin fluorine bluelanthanum reagent. The colored stream passes through a 15-mm tubular flow cell of a colorimeter, and the absorbance is measured at 624 millimicrons. The impulse is transmitted to a recorder. The colorimetric and distillation systems of the method are discussed. The normal range of analysis is from 0.1-4.0 micrograms F/ml, although the upper limit can be extended with modified procedures. The standard error or a single determination is between 2 and 8 micrograms, depending on the kind of plant tissue and the level of fluoride. Indirect accuracy determinations show no significant deviations from linearity. Frequent checks for precision and accuracy of the method are required. Details are given of interferences, apparatus, reagents, procedure (including tissue preparation, ashing and alkali fusion, automated analysis, maintenance, and problem detection), calibration and standards, calculation, and effect of storage. The method is termed tentative until it is adopted as standard.
APTIC-23547

### TENTATIVE METHOD OF ANALYSIS FOR NITROGEN DIOXIDE CONTENT OF THE ATMOSPHERE (GRIESS-SALTZMAN REACTION).

42602-01-68T. Health Lab. Sci., 6 (2):106-113, April 1969. 12 refs.
B. E. Saltzman, W. A. Cook, B. Dimitriades, E. L. Kothny, and L. Levin.
Identifiers: *Saltzman method, *Spectrophotometry, *Nitrogen dioxide (n2), Manual, Analytical methods, Azo dye, Gas sampling, Stack sampling, Calibration methods, Nitrogen dioxide (no2).

Nitrogen dioxide is absorbed in an azo dye forming reagent. A stable pink color is produced within 15 min which may be read visually or in an appropriate instrument at 550 millimicrons. The method is intended for the manual determination of $NO_2$ in the atmosphere in the range of 0.005 to about 5 ppm by volume or 0.01-10 micrograms/liter, when sampling is conducted in fritted bubblers. The method is preferred when high sensitivity is needed. Concentrations of 5-100 ppm in industrial atmospheres and in gas burner stacks also may be sampled by using evacuated bottles or glass syringes. For higher concentrations, automotive exhaust, and/or samples relatively high in sulfur dioxide content, other methods should be applied. A precision of 1% of the mean can be achieved with careful work. Details are given of interferences, apparatus, reagents, procedure (including sampling by bubbler, glass syringe, and evacuated bottle), calibration and standardization, calculations, and effects of storage. The method is termed tentative until it is adopted as standard.
APTIC-23548

### TENTATIVE METHOD OF ANALYSIS FOR ARSENIC CONTENT OF ATMOSPHERIC PARTICULATE MATTER.

12103-01-68T. Health Lab. Sci., 6 (2):57-60, April 1969. 5 refs.
E. C. Tabor, M. M. Braverman, H. E. Bumstead, A. Carotti, and H. M. Donaldson.
Identifiers: *Photometric methods, *Arsenic compounds, Particulates, Sampling methods, Particulate sampling, Membrane filters, Glass fabrics, Calibration methods.

Arsenic compounds are dissolved from a suitable sample (10 cu m of air collected either on membrane or glass fiber filters) of particulate matter with hydrochloric acid followed by reduction of arsenic to the trivalent state with KI and $SnCl_2$. This is then reduced to arsine, which is passed through an $H_2S$ scrubber into a solution where it reacts with silver diethyldithiocarbamate to form a substance suitable for photometric measurement with a maximum absorbance at 535 millimicrons. Samples were determined with an accuracy of plus or minus 0.04 micrograms. Interferences are with antimony and high concentrations of nickel, copper, chromium, and cobalt, and certain combinations. Concentrations from 0.1 to 1.5 micrograms As/cu m can be measured, as well as higher concentrations if smaller samples are used. This method replaces a Gutzeit treatment and a titrimetric method involving the absorption of arsine in mercuric chloride and subsequent iodometric determination. Apparatus, reagents, procedure, calibration, calculations, and effect of storage are given. The method is termed tentative until it is adopted as standard.
APTIC-23549

### STACK SAMPLING PROCEDURES USED TO EVALUATE EMISSIONS.

Manufacturing Chemists Association, Washington, D. C., Air Pollution Abatement Committee and Manufacturing Chemists Association, Washington, D. C., Water Pollution Abatement Committee. Proc. Mfg. Chem. Ass. 1952-53 Pollution Abatement Conf., 10p., 2 refs.
J. B. Gisclard.
Identifiers: *Stack sampling, Scrubbers, Sulfur dioxide, Hydrogen sulfide.

Stack sampling is important from an air pollution prevention standpoint for the following reasons: 1) Data are obtained on peak concentrations which are often the cause of complaints. 2) Predictions and calculations of concentrations of airborne material downwind require knowledge of stack concentrations. 3) When correlated with outdoor air sampling, stack sampling should prove or disprove causes of complaints. 4) Chemical analysis of the emission is frequently facilitated by the heavier concentration found within the stack. 5) Proper engineering design for scrubbers or collectors is easier to achieve. For gases such as sulfur dioxide and hydrogen sulfide and vapors such as aniline and acid mists sufficiently accurate evaluations of stack emissions in terms of pounds per hour or per day can be obtained by spot sampling combined with further data on the size of the stack, volume of emission, temperature, and frequency of batch operations. This is particularly true when scrubbers have been designed on the basis of information provided by stack sampling.
APTIC-23555

### RESULTS OF THE INTERNATIONAL COMPARISON OF INSTRUMENTS FOR MEASUREMENT OF THE ARTIFICIAL BETA RADIOACTIVITY OF DUSTS IN AIR (DEVICES WITH FIXED FILTERS) ORGANIZED BY THE ROYAL METEOROLOGICAL INSTITUTE OF BELGIUM.

(Resultats de la comparaison internationale des instruments de mesure de la radioactivite artificielle beta des poussieres de l'air (appareils a filtres fixes) organisee par l'Institut Royal Meteorologique de Belgique). Text in French.
Koninklijk Meteorologisch Inst. van Belgie, Brussels, Pub. Series A-no. 67, 30p., 1969. 11 refs.
CFSTI: N70-17217
J. Grandjean, R. Sneyers, and C. Levert.
Identifiers: *Measurement methods, *Statistical analyses, *Beta particles, International, Belgium, Dusts.

The objective of work carried out during 1964 and 1965, was to render data on artificial beta radioactivity of airborne dusts measured by diverse instruments used in the air-sampling networks of Belgium, France, Holland and (West) Germany comparable with each other, so as to be able to obtain the least biased representation of the geographical distribution of the artificial beta radiation. The method of comparison adopted in this work is described. The approach utilizes probabilistic methods of analysis of random time series. By statistical analysis of series of simultaneous measurements carried out by the various instruments in the several countries, the great diversity of sources of indeterminacy associated with each type of instrument was made evident. Special attention was paid to the stability of operation of these instruments. Some of them were quite inadequate for their task. In all, the goal of the undertaking was attained.
APTIC-23557

### RAPID ITLC FLUORIMETRIC METHODS FOR THE ASSAY OF PHENALEN-1-ONE AND 7H-BENZ (DE)ANTHRACEN-7-ONE IN POLLUTED URBAN ATMOSPHERES.

Preprint, National Center for Air Pollution Control, Cincinnati, Ohio, Chemical and Physical Research and Development Program, 23p., Feb. 1968. 4 refs.
Carole R. Engel, and Eugene Sawicki.
Identifiers: *Thin-layer chromatography, *Phenalen-1-one, *7h-benz (de)anthracen-7-one, Anthracenes, Phenanthrenes.

Through the use of glass-fiber paper impregnated with silica gel (called instant thin-layer chromatography, or ITLC), the rapid determination of phenalen-1-one (PO) and 7H-benz (de)anthracen-7-one (BO) is facilitated. One method is introduced for the specific determination of PO, and one method for the determination of both PO and BO at the same time. Both methods are superior to previous methods in terms of speed, selectivity, simplicity, and sensitivity. In addition, they give reasonable accuracy and precision. Samples from urban atmospheres and air pollution source effluents can be analyzed rapidly for PO and BO by these methods. Analysis of one sample of organic extracts would take less than 1/2 hour, analysis of a dozen samples would take less than 2 hours. For those laboratories without instrumentation the amount of PO and BO can be estimated by eye after separation, eight analyses for either compound can be accomplished in about 20 minutes. (Author abstract)
APTIC-23558

### CORRECTION FOR OXIDATION OF NITROGEN IN THE DETERMINATION OF HEAT OF COMBUSTION.

Tr. Vses. Nauch. Issled. Inst. Metrol., 111 (171):95-102, 1969. 11 refs. Translated from Russian by D. P. Biddiscombe, Ministry of Technology (England), Div. of Chemical Standards, 11p., March 1970. CFSTI: N70-28918
Yu. I. Aleksandrov, V. D. Mikina, and G. A. Novikov.
Identifiers: *Nitrogen oxides, *Heat of combustion, *Oxygen calorimeter bombs, Ussr, Chemical methods, Electrochemical methods, Nitric acid, Nitrous acid, Nitric oxide (no), Nitrogen dioxide (no2), Oxidation, Water, Reaction mechanisms.

At present, the heat effect due to oxidation of nitrogen in a calorimetric bomb is computed on the basis of determination of the amount of nitric acid after the calorimetric experiment by titration of the bomb liquid with a 0.1-N solution of alkali; methyl orange is used as indicator. Results obtained during a prolonged period of work, by titration of bomb liquid after combustion of benzoic acid, differed one from another more than was to be expected from the errors of the titration method. Analysis of literature data on the formation of nitric acid does not give a thorough explanation of this discrepancy in titration results. To elucidate the reasons for this discrepancy, a study was made of the dependence of the amount of nitric acid formed upon the ageing time of the combustion products in the bomb, upon the initial concentration of nitrogen, upon the size of the flame, and upon the pressure of oxygen in the bomb. Study of the process of oxidation of nitrogen in the calorimetric bomb has established that, by the end of an experiment, when the bomb is opened, the reaction between nitrogen dioxide and water is not complete, and thus the end-product contains not only nitric acid, but also nitrogen dioxide. By the end of the main period, the amount of each component depends upon the initial concentration of nitrogen in the oxygen, the size of the flame during combustion of the substance, and the time of flushing of the bomb with oxygen. The amount of nitric acid formed depends upon the time of ageing of the combustion products in the bomb. In calorimetric practice at the present time, only the process of nitric acid formation is taken into account. On the basis of the investigations carried out, a procedure for determining the correction for oxidation of nitrogen, taking account of the incomplete conversion of oxides of nitrogen into nitric acid, is advised. In order to determine more precisely the make-up of the correction, the methods of its determination must be changed. To calculate the correction, it is necessary to determine the amount of nitric acid formed by the end of the main period of a calorimetric experiment and thus establish the amount of nitrogen dioxide present at that time in the gas phase in the bomb.
APTIC-23560

### AN INSTRUMENT FOR CONTINUOUS MEASUREMENT OF DUST CONCENTRATION.

Metallurgist (USSR) (English translation from Russian of: Metallurg.), no. 5-6:390-391, May-June 1969.
V. Oparysheva
Identifiers: *Dusts, *Electroconductivity analyzers, *Sampling probes, *Design criteria, Ussr, Blast furnaces, Continuous monitoring, Particle size

The operating principle of the instrument 'Konitest', which was designed for continuous measurement of the concentration of dust in the air and blast furnace gases, is based on the measurement of an electric current which is generated as a result of interaction between particles of dust and a charging element. In the first version of the instrument, the charging element is a vortex tube to which is attached a centrifuge; it imparts a rotary movement to the dust and air mixture, as a result of which most of the dust is thrown towards the walls of the tube. A venturi nozzle is provided for measuring the discharge of gas in the second version of the instrument, although it can also be used for measuring the concentration of dust in a gas flow. The probe acts as the charging element in the third version and consists of a grid whose bars are made of a material which can carry a high electric charge. High sensitivity of the instrument 'Konitest' enables continuous measurement of dust particles of less than 5 micron to be carried out.
APTIC-23564

### CURIUM PROCESS DEVELOPMENT. III-5. QUANTITATIVE DETERMINATION OF DIETHYLBENZENE IN AIR.

Du Pont de Nemours (E. I.) and Co., Aiken, S. C., Savannah River Lab., AEC Contract AT (07-2)-1, 11p., April 1970. 2 refs. CFSTI: DP-1230
Burton Tiffany.
Identifiers: *Gas chromatography, *Diethylbenzene, Occupational health, Air quality measurements, Flame ionization detector, Experimental methods, Benzenes, Temperature.

A gas chromatographic method was developed to determine the diethylbenzene concentration in the atmosphere of work areas in which this solvent is handled. Studies with animals have indicated that DEB has a low oral toxicity with the mean lethal dose being greater than 1-2 g/kg, and that DEB produces adverse systemic effects only when exposures are prolonged and repeated. Samples were collected in 0.5-liter glass bulbs, which were first purged for several minutes with a small air pump. These bulbs were previously coated with 'Desicote' to minimize adsorption of DEB to the wall. A 10 cu cm aliquot of air sample was injected into a gas chromatograph packed with diatomaceous earth and coated with a silicone oil. The sample port and detector block temperatures were maintained at 200 C, while the column temperature, initially at 125 C, was programmed to increase to 175 C at 16 C/min after sample injection. Helium was the carrier gas. Diethylbenzene was separated and determined quantitatively with a flame ionization detector. The minimum concentration of DEB in air which was detected by this method was 0.2 ppm.
APTIC-23565

### MEASUREMENT OF POLYCYCLIC AROMATIC HYDROCARBONS IN THE AIR OF SYDNEY USING VERY LONG ALUMINA COLUMNS FOR SEPARATION.

Intern. J. Air Water Pollution (London), vol. 7:753-767, 1963. 18 refs.
Graham J. Cleary.
Identifiers: *Chemical composition, *Column chromatography, *Polynuclear compounds, Australia, Urban areas, Spectrophotometry, Anthracenes, Chrysenes, Fluoranthenes, Perylenes, Phenanthrenes, Pyrenes.

Quantitative measurements of polycyclic hydrocarbon levels in the inner city area of Sidney are presented. Included are the wavelengths used in the measurements. Air-particulate samples were collected on filter pads and the pads extracted with acetone. The extracted liquid was then evaporated to eliminate the acetone and the residue developed in cyclohexane. Individual compounds were separated from the solution on activated alumina columns, 23 times 1/2 in. diameter, developed with cyclohexane. The ultraviolet spectra of the eluted fractions were determined with a split-beam ratio-recording spectrophotometer. The long alumina columns had marked advantages in the degree of separation attainable. The elution sequence graph for the pure substances showed much better separation of pyrene-fluoranthene and 1,12 benzperylene-coronene than previously achieved. Even for the compounds 9,10 benzphenanthrene-1,2 benzanthracene and 1,2 benzanthracene-chrysene, the amount of mixing was relatively small. The importance of spectral analysis for the discrete separation of individual fractions is stressed, and variations in polycyclic ratios of the samples with variations in air-polluting activity are discussed.
APTIC-23566

### A RADIOTRACER STUDY OF THE PRODUCTION OF FORMALDEHYDE IN THE PHOTO-OXIDATION OF ETHYLENE IN THE ATMOSPHERE. PART I: METHOD AND PROCEDURES.

J. Air Pollution Control Assoc., 14(5):158-160, May 1964. 15 refs.

S. W. Nicksic, J. Harkins, and B. A. Fries.
Identifiers: *Engine exhausts, *Formaldehydes, *Radioactive tracers, Chemical methods, Flame ionization detector, Colorimetry, Photooxidation.

Results are presented for experiments in which formaldehyde in irradiated engine exhaust gas was determined both chemically and radiochemically. In runs where ethylene was the only source of formaldehyde, agreement between the radiochemical and chemical methods was good. In a run where trans-2-butene was added to exhaust mixtures instead of ethylene, which was present only in the radiotracer, the chemical formaldehyde reading was high but the radioactive formaldehyde showed relatively low concentrations coming from ethylene. Despite the low radioformaldehyde reading, the proportion of added ethylene going to formaldehyde was about the same (20%) as in the other runs. This suggests that the reactions involving ethylene are kinetically independent of those involving higher olefins such as trans-2-butene, even when the latter is present at a concentration 100 times that of ethylene. The accuracy of the radiotracer method is plus or minus 2%, and specificity for formaldehyde appears to be as good as that of the chromotropic acid method. With the tracer technique, it should be possible to identify intermediate products the rearrangement or decomposition of which takes place prior to the final step resulting in formaldehyde.
APTIC-23567

### THE 'USPHS' METHOD FOR DETERMINING LEAD IN AIR AND IN BIOLOGICAL MATERIALS.

Am. Ind. Hyg. Assoc. J., 24 (5):481-491, Sept.-Oct. 1963. 4 refs.
Robert G. Keenan, Dohrman H. Byers, Bernard E. Saltzman, and Francis L. Hyslop.
Identifiers: *Spectrophotometry, *Lead compounds, Hematology.

The USPHS method for lead determination is a double-extraction, mixed-color dithizone procedure that is especially convenient for lead analysis in the absence of bismuth. Complete details of the method, as fully refined after 26 years of research and development, are presented along with associated information on sample collecting, ashing, purification of reagents, and other preparative procedures. Also included is a rapid procedure for the removal of a known area of paint film from a sheet metal surface and the determination of its lead contents in terms of percentage or of milligrams of lead per square inch of surface. As determined by laboratory evaluations of the refined USPHS method, the procedure provides a mean lead recovery of 97.1% for lead in whole blood samples. Among replicate analyses, the coefficient of variations ranged from 4.0% to 9.3% for samples containing, respectively, 0.291 to 0.020 mg Pb/100 grams whole blood.
APTIC-23568

### MICRODETERMINATION OF FLUORIDE USING AN IMPROVED DISTILLATION PROCEDURE.

Anal. Chem., 37 (10):1276-1278, Sept. 1965. 7 refs.
Marven A. Wade, and Stanley S. Yamamura.
Identifiers: *Spectrophotometry, *Fluorides, *Distillation, Colorimetry

A versatile microdistillation procedure was developed for separating microgram levels of fluoride from anions and cations that interfere in colorimetric fluoride procedures. The distillation is carried out from a phosphoric acid medium with a microdistillation flask modified to minimize the carryover of phosphate and sulfate. The fluoride in the distillate is determinable by a number of colorimetric methods. In the study reported, the improved distillation-separation procedure was coupled with an Alizarin Complexone spectrophotometric measurement of fluoride. This resulted in a reliable method that appears to be suitable for a wide variety of samples. Of the 42 diverse ions tested (most of them at the 500 to 1 diverse ion-to-fluoride molar ratio), only borate and silicate interfered seriously. Based on 22 determinations at the 20-microgram fluoride level, the standard deviation of the combined distillation-spectrophotometric procedure is 3.0%.
APTIC-23569

### DETERMINATION OF LEAD IN GASOLINE BY ATOMIC ABSORPTION SPECTROSCOPY.

Anal. Chim. Acta, vol. 24:451-455, 1961. 2 refs.
J. W. Robinson.
Identifiers: *Gasolines, *Spectrophotometry, *Lead compounds, Photometric methods, Calibration methods, Experimental methods, Tetraethyl lead, Fluorescence.

A procedure was developed for the direct determination of lead in gasoline by atomic absorption spectroscopy. Time for complete analysis, including calculation, is approximately 10 min, and the equipment is relatively inexpensive. Interference from metals normally present in this type of sample is not encountered, nor do the sulfur and nitrogen content and variation in the carbon/hydrogen ratio cause problems. At 2833-A, the degree of absorption was so intense that the useful range of analysis was limited to between 0 and approximately 70 ppm of lead. To accommodate this limited range, it was necessary to dilute all samples ten-fold. For this dilution, isooctane was used. Modulation in the equipment was also necessary in order to eliminate difficulties arising from the emission line of lead which occurs at the same wavelength as the absorption line. Standard solutions of tetraethyl lead are made up by dissolving in iso-octane.
APTIC-23571

### ISOLATION AND DETERMINATION OF MICROGRAM AMOUNTS OF FLUORIDE IN MATERIALS CONTAINING CALCIUM AND ORTHOPHOSPHATE.

Anal. Chem., 34 (10):1296-1298, Sept. 1962. 13 refs. (Presented at the American Chemical Society, Division of Analytical Chemistry, 141st Meeting, Washington, D. C., March 1962.)
H. Whitney Wharton.
Identifiers: *Diffusion, *Fluorides, *Spectrophotometry, Experimental methods, Hydrofluoric acid, Calcium compounds, Phosphates.

Up to 4 micrograms of fluoride can be separated from dental enamel by gaseous diffusion of hydrogen fluoride from a perchloric acid solution of the sample in a polypropylene Conway diffusion dish. The HF is trapped in sodium hydroxide, while the resulting fluoride is determined spectrophotometrically by an improved zirconium-SPADNS (4,5-dihydroxy-3- (p-sulfophenylazo)-2,7-naphthalenedisulfonic acid, trisodium salt) bleaching method. Accuracy and reproducibility of the entire method are to plus or minus 0.05 microgram of fluoride at the 1 microgram level and plus or minus 0.07 microgram at the 3 microgram level. (Author abstract)
APTIC-23573

### REPORT ABOUT MEASUREMENTS OF WASTE GAS AT THE GRILLO DE-SULFURIZATION INSTALLATION AT UNION RHEINISCHE BRAUNKOHLEN-KRAFTSTOFF AG FIRM IN WESSELING.

Bericht uber Abggasmessungen an der Grillo-Entschwefelungsanlage bei der Firma Union Rheinische Braunkohlen-Kraftstoff AG in Wesseling). Landesanstalt fuer Imissions-und Bodennutzunsschutz des Landes Nordhein-Westfalen, 46p., 1970. Translated from German. Belov and Associates, Denver, Colo., 11p., Sept. 9, 1970.
J. Sieth.
Identifiers: *Fluorine compounds, *Stack gases, *Measurement methods, *Alkaline additives, Germany, Particulates, Dusts, Stack sampling, Centrifugal separators, Scrubbers, Sulfur trioxide

Research involving a stack gas cleaning operation for particulates, fluorine, and desulfurization is described. Sulfur trioxide and sulfur dioxide quantitites remaining in the treated gas are measured. Treatment consists of dry alkaline additives, followed by cyclones and scrubbers. Stack samples are taken at four points; the methods and equipment are described. According to fluorine measurements, the optimum fluorine reduction is achieved in the desulfurization installation. No amounts of sulfur trioxide are detectable in the treated gas when the proper amount of desulfurizer is used.
APTIC-23575

### DAYTIME TRACKING OF A HIGH-ALTITUDE VAPOR TRAIL.

J. Atmospheric Sci., 27 (6):979-980, Sept. 1970. 2 refs.
Gordon T. Best.
Identifiers: *Radiation measuring systems, *Design criteria, *Vapors, Missles and rockets, Experimental equipment, Lithium compounds.

In a comparative analysis of several alternative systems for daylight tracking of vapor trails, it was determined that a useful instrument could be realized by building differential radiometer which would compare the signal from a small field of view in two narrow adjacent spectral regions, only one of which contained the spectral emission feature of the vapor trail. The advantage of the radiometer technique is that detection depends not only on the ratio of feature to background intensity, but rather on the ratio of the square of the feature intensity to the product of the background intensity and the electronic bandwidth of the system. Using commercially fabricated interference filters of 2.5 A half-width, a simple instrument of this type was built. The solid angular field at the filter was 0.01 rad diameter, determined by the spatial resolution required in object space. By adding an afocal telephoto system, it is possible to achieve at least a ten-fold increase in throughput with a consequent three-fold gain in signal-to-noise ratio, without significantly degrading the spectral resolution. The instrument was set up at Tyndall AFB, some 120 km to the east of the launch site at Eglin AFB, and used to track a trail of lithium vapor from a Nike-Iriquois rocket.
APTIC-23591

### INSTRUMENTS FOR MEASURING HAZARDOUS ATMOSPHERES.

Fire J., 64 (5): 76-80, 87, Sept. 1970.
J. E. Zatek.
Identifiers: *Potentiometric methods, Portable, Gasolines, Flame ionization detector, Continuous monitoring, Design criteria, Acetylenes, Lead compounds, Carbon monoxide, Oxygen, Vapors.

A number of commercially available instruments, both portable and of the continuous or permanently installed type, have been developed for specific analysis of environmental contaminants. The basic principle of operation of hot-wire indicators is a change in the electrical resistance of hot platinum filament that is caused by the heat of combustion of a sample of the gas-air mixture passing over the filament. Several styles of combustible gas indicators have been designed to be calibrated to measure specific combustibles. To test vapors of leaded gasoline, the manufacturers boosted the voltage across the detector to maintain a sufficiently high filament temperature to prevent decontamination. The indicators are equipped with specially designed heavy-duty flashback arresters to test atmospheres that may contain mixtures of acetylene or hydrogen with more oxygen than is normally found in air. Since the threshold limit value for many gases and vapors represents a very small fraction of the lower explosive limit concentration, other models are equipped with a dual-scale meter graduated from 0 to 100% and 0 to 10% of the lower explosive limit. Checking devices are also available to verify the performance of a hot-wire instrument. Limitations of the instrument are cited. During the past decade, equipment manu-

facturers developed detector tubes in which a bed of sensitive chemical confined between two porous plugs responds to a specific material by length of color change or stain proportional to the atmospheric concentration. Another important instrument uses the heat-of-combustion principle to measure carbon monoxide, while oxygen detection is accomplished with a primary galvanic cell consisting of a zinc and hollow carbon electrode in a special electrolyte. Diffusion head instruments are available for central monitoring of combustible gases at multiple remote locations up to 5000 ft from the control unit or in single-point instruments constructed for general purpose use or explosion proof applications. Another extremely sensitive means for measuring hydrocarbons is based on the ionization of carbon atoms in a hydrogen flame.
APTIC-23596

### THE RESPONSE OF CARBON DISULPHIDE IN A FLAME IONIZATION DETECTOR.

J. Chromatographic Sci., 8 (7):414-415, July 1970. 5 refs.
A. T. Blades.
Identifiers: *Flame ionization detector, *Carbon disulfide, *Reaction mechanisms, Canada, Operating variables, Methanes, Hydrogen, Ions.

An attempt has been made to examine the chemical origin of the various response features of carbon sulfide in a hydrogen flame ionization detector in order to define the precautions necessary in the use of the detector for CS2 estimation. A 60 cm diisooctyl phtlalate on a firebrick GC column at 25 C was used for purification of the CS2, and concentrations were measured by a catharometer immediately before the hydrogen flame detector. Flame additives were normally introduced by a gas syringe, but methane was sometimes introduced continuously through a fine capillary. In the concentration range up to 0.01%, the response was proportional to concentration, as is observed with most organic compounds, and the sensitivity relative to methane was 0.16 for H2 at 30 cc/min and 0.08 for H2 at 60 cc/min. The significant chemistry in this concentration range presumably involves the conversion of a small fraction of the CS2 to CH, the ion precursor in the chemi-ionization reaction. At higher concentrations, the response curve reaches a maximum at 0.07%, then declines, finally reaching a minimum at about 2% CS2. In this region, chromatographic peaks go through the sequence of being flat topped, then progressively more inverted as the sample size is increased. In a flame containing only CS2 as additive, both the ion precursor CH and a sulfur species must arise from the CS2, and hence there exists in the flame a process, second order in CS2, which tends to inhibit ion formation. A dramatic increase in response occurred in the concentration region above about 3% CS2, which probably arises from some surface process on the collector electrode, the sulfur in the flame being responsible merely for bringing the reacting gases closer to the electrode.
APTIC-23615

### THE EFFECT OF HYDROGEN CHLORIDE ON THE OPERATION OF THE THOMAS AUTOMETER.

Preprint, Air Pollution Control Assoc., Pittsburgh, 10p., 1956. 5 refs. (Presented at the Air Pollution
Control Association Annual Meeting, 49th,
Buffalo, N. Y., May 20-24, 1956, Paper 56-4.)
J. E. Yocom, R. L. Richardson, I. M. Saslaw, and S. Chapman.
Identifiers: *Hydrochloric acid, *Sulfur dioxide, *Thomas autometer, Electroconductivity analyzers, Absorption, Sulfuric acid, Hydrogen, Peroxides, Reaction kinetics.

The Thomas autometer is one of the most widely used instruments for detecting minute concentrations of sulfur dioxide in gases by continuously recording the change in electrical conductivity of an acidulated hydrogen peroxide solution through which the SO2-bearing gases are passed. In atmospheres where SO2 is admixed with gaseous electrolytes, the effect of the added gas on the conductivity of the absorbing solution would be additive to an unknown extent. Thus, experiments were performed to determine the absorption efficiency and average over-all mass-transfer coefficient for the hydrogen chloride-autometer system using sulfuric acid-hydrogen peroxide absorbing solution. The presence of hydrogen chloride affects the operation of the Thomas autometer. The effects of HCl-air mixtures in concentrations ranging from 1.2 to 11.4 ppm were studied; they recorded at about 75% of their true concentrations. Average mass transfer coefficients for the system are determined. A dynamic gas mixing apparatus is described. (Author abstract modified)
APTIC-23627

### A VERSATILE, HIGH FLOWRATE TAPE SAMPLER.

Preprint, Robert A. Taft Sanitary Engineering
Center, Cincinnati, Ohio, Community Air
Pollution Program, 11p., 1956 (*). 5 refs.
John S. Nader.
Identifiers: *Flow rates, *Particulates, *Membrane filters, Particulate sampling, Samplers, Design criteria.

The development, construction and operation of a versatile, high flowrate tape sampler for atmospheric particulate matter is described. Total air flowrate through a filter area of 2 square centimeters is adjustable over a range from 5 to 32 liters per minute. The filter medium is the type WS microweb membrane in tape form. A number of nondestructive analyses (mass loading, soiling, radioactivity, and x-ray diffraction) and one or two destructive type tests (microchemical analysis, particle count, and size distribution) may be performed on particulate matter as it exists on the membrane tape. The instrument has been designed as the basic unit of a system of several accessory units by which various types of analyses can be made automatically on the sampled tape. Compared to similar samplers in current use, its flowrates are relatively high per unit area of filter medium, and it concentrates a relatively large mass of particulates in the sample spot. (Author abstract modified)
APTIC-23629

### THE LASER IN METEOROLOGY.

Discovery, J. Sci., vol. 26:30, 31, 34, 35, 50, July
1965. 2 refs.
Myron G. H. Ligda.
Identifiers: *Lasers, *Meteorology, Aerosols, Visibility, Clouds.

Use of lidar for probing clouds and studying aerosols in the atmosphere is now revealing new information about the atmosphere, its structure, fine scale motion, and man's modification of it. The giant pulse ruby laser produces radiation that has six basic properties which make practical its use as the transmitting unit for lidar: the great intensity of the radiation enables detection of targets at useful ranges by backscattering; the monochromatic nature of the radiation makes it possible to employ filters in the receiver to reject light of undesired wavelengths; coherency of the radiation enables optical systems with small apertures to be used to generate narrow beams of light; light emerging from the laser may be highly plane polarized; brevity of the pulse enables one to achieve good resolution; and the very narrow and almost perfectly parallel beam which emerges greatly simplifies the design of the transmitting optics. Possible use of lasers to determine visibility is mentioned, as well as clean air observations. Radar heritage and the future of lidar are indicated.
APTIC-23632

### SPECIFIC THERMOCHROMIC DETECTION OF ANTHRACENE COMPOUNDS.

Robert A. Taft Sanitary Engineering Center,
Cincinnati, Ohio, Air Pollution Engineering
Research, 5p., 1959. 9 refs.
Thomas R. Hauser.
Identifiers: *Colorimetry, *Anthracenes, *Chromium oxides, Acetic acid, Naphthacenes, Oxidation, Temperature.

Although many color tests for anthracene have appeared in the literature, none of them is specific, and the need for a simple specific test is evident. If anthracene and its simple derivatives are oxidized with chromium trioxide in acetic acid, the corresponding p-anthraquinone is formed, and these resulting p-quinones can be detected easily by a well-established reversible thermochromic reaction. For example, anthraquinone gives a colorless solution at room temperature and a red-violet color at the boiling point. A test procedure and results are indicated. The presence of amino or hydroxyl groupings in the 1- or 2- position of anthracene apparently causes oxidation of the terminal ring. Thereby, a negative test results because the formation of an anthraquinone is less likely. Hydrocarbons containing the anthracene type nucleus were also tested. Naphthacene, benz (a)anthracene, and dibenz (a,h)anthracene were also oxidized to the p-dione structure, and positive detection was experienced again only when large amounts of the hydrocarbon were tested.
APTIC-23633

### ATMOSPHERIC DUST RECORDS IN GLACIAL SNOWFIELDS: IMPLICATIONS TO MARINE SEDIMENTATION.

For primary bibliographic entry see Field 05.
APTIC-23646

### AUTOMATED INSTRUMENTATION SYSTEM FOR MASS SPECTROMETRIC GAS ANALYSES.

California Univ., Livermore, Lawrence Radiation
Lab., Rept. UCRL-50738, 17p., Aug. 27, 1969.
CFSTI: N70-22781
Richard W. Crawford, Ronald K. Stump, and
Klaus Ernst.
Identifiers: *Gas sampling, *Instrumentation, *Mass spectrometry, Measurement methods, Automatic methods, Continuous monitoring, Design criteria.

An automated instrumentation and data acquisition system that analyzes gases by mass spectrometry is described. This system continuously monitors chemical reactions in several closed reaction vessels by automatically sampling and analyzing the gas compositions at predetermined, but variable, time intervals. Mass spectral data are recorded on an oscillograph recorder. Simultaneously, mass-number and peak-height information is digitized, printed out, and punched on a fast paper-tape punch. Some operational data is presented.
APTIC-23653

### SPECTROPHOTOMETRIC DETERMINATION OF FLUORIDE IN WATER.

Anal. Chem., 32 (10):1330-1332, Sept. 1960. 8 refs.
Floyd I. Brownley Jr., and Charles W. Howle Jr.
Identifiers: *Thorium-phenylfluorone, *Spectrophotometry, *Fluorides, Operating variables, Fluorinated hydrocarbons, Ions, Ph.

A spectrophotometric method for the determination of fluorides in water is described which is based upon the colored complex formed between thorium and phenylfluorone. Experiments were designed to establish the optimum pH, optimum development time, and best ratio of color-producing reagents, and to ascertain the interferences from ions normally found in surface water. A pH of 3.6 was selected as best, since the absorbance was more nearly a linear function of the fluoride concentration at this pH. Color development ap-

pears to be almost instantaneous and absorbance is constant for at least an hour. However, necessary manipulation time for 10 or more samples would preclude the use of periods shorter than 25 min. A ratio of 2 ml of thorium nitrate solution to 2 ml of phenylfluorone solution was selected to produce a colored solution which would not be so optically dense as to be insensitive to small amounts of fluoride. When it became apparent that iron would interfere seriously, it was decided to eliminate completely all cations through the use of an ion exchange resin.
APTIC-23654

### A FIELD METHOD FOR DETERMINING TOTAL AIR-BORNE LEAD.

Analyst, vol. 85:122-126, Feb. 1960. 11 refs.
B. E. Dixon, and P. Metson.
Identifiers: *Colorimetry, *Field tests, *Lead compounds, Great britain, Dusts, Experimental methods.

A field test is described for determining small amounts of total airborne lead in industrial atmospheres. The sample is collected on a test paper, which is then treated in a graduated sample tube with cold dilute nitric acid containing hydrogen peroxide to dissolve the lead dust and disintegrate the paper. Measured amounts of ammoniacal cyanide-metabisulfite-citrate solution and a solution of dithizone in carbon tetrachloride are successively added, and the lead dithizonate is extracted at pH 11. The color of the lower layer is compared with aqueous color standards or permanent glass color standards. For comparative purposes, the lead content of the dithizonate solutions was also determined spectrophotometrically. Bismuth, thallium, and stannous tin would, if dissolved in the treatment of the sample, be extracted with lead to form colored dithizonates. The possible constituents of industrial dusts are legion, and it would not be safe to assume non-interference in the field test by unknown major constituents of a dust without thorough investigation. (Author abstract modified)
APTIC-23655

### A METHOD FOR IDENTIFYING PARTICULATE FLUORIDE COMPOUNDS.

Anal. Chim. Acta, vol. 23:209-214, 1960. 13 refs.
(Presented at the American Chemical Society, Air Pollution Symposium, Sept. 1959.)
Barbara J. Tufts.
Identifiers: *Microscopy, *Fluorides, Particulates, Particulate sampling, Membrane filters, Calibration methods, Hydrofluoric acid, Chlorides, Lead compounds, Silicates, Crystal structure.

A method is described for identifying particulates containing fluorides and other complex fluorine compounds such as fluosilicate in samples collected on membrane filters. The filter is treated with lead chloride to precipitate lead chlorofluoride at each fluoride-containing spot, and this microspot is identified by examination in a light microscope. Sulfate and phosphate, which also precipitate if present, can be distinguished and do not interfere. The fluoride precipitates are best seen as anisotropic white crystals in the optical microscope with crossed polars. They show polarization colors, which are especially distinctive in precipitates greater than 10 micron in diameter. Calibrations are given for the fluorides and the more insoluble salts, relating the original particle size to the reaction site size. Thus the mass of the particles can be calculated. Results of some field tests in an area of fluoride pollution are given, and compared with standard testing procedures. Samples containing hydrogen fluoride cannot be shipped or stored but must be reacted immediately after collection. (Author summary modified)
APTIC-23657

### AN ELECTRON MICROSCOPE STUDY OF PARTICLES IN TOWN AIR.

For primary bibliographic entry see Field 04.
APTIC-23662

### SPECTROPHOTOMETRIC DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS SEPARATED BY THIN-LAYER CHROMATOGRAPHY, AND EVALUATION OF THE LIGHT SENSITIVITY OF HYDROCARBON SPOTS.

J. Chromatog., 20 (1):168-171, Oct. 1965. 10 refs.
Jorgen Lam, and Arne Berg.
Identifiers: *Thin-layer chromatography, *Spectrophotometry, *Polynuclear compounds, Europe, Anthracenes, Chrysenes, Perylenes, Pyrenes, Benzo (3-4)pyrene, Fluorescence.

Anthracene, pyrene, 3,4-benzopyrene, perylene, 1,12-benzoperylene, and chrysene were determined in the wavelength region above 300 millimicrons by means of thin-layer chromatography. Separation on silica gel plates impregnated with caffeine resulted in better than 80-90% recovery of anthracene, pyrene, and perylene. Results were poorer and more varied for 3,4-benzopyrene, and chrysene absorbed too weakly to be determined under the given conditions. Extractions with 5 and 3 ml of ethanol, respectively, were performed on plates having smaller amounts of pyrene and 3,4-benzopyrene. Recovery was 75% and 40%, respectively, indicating that the general extraction procedure cannot be reduced to below 5 ml without depreciating the results. To determine the effect of prolonged exposure to light, a caffeine-impregnated silica gel plate, and ordinary silica gel plate, and an alumina plate were each spotted with hydrocarbons, developed in a darkened room, and exposed to air and daylight for several days. After a short time, the spots on the two latter plates darkened and the fluorescence weakened. The spots on the caffeine-impregnated plate were completely unchanged after four days. Determinations of anthracene, pyrene, 3,4-benzopyrene, perylene, and 1,12-benzoperylene were also made for coal tar samples. The amounts found agree well with published values.
APTIC-23666

### MOLECULAR-BEAM SAMPLING OF GAS MIXTURES IN CYCLING-PRESSURE SOURCES.

California Univ., Los Angeles, School of Engineering and Applied Science, Grant 5 RO1 AP00834-02, 11p., 1970. 6 refs.
W. S. Young, W. E. Rodgers, C. A. Cullian, and E. L. Knuth.
Identifiers: *Supersonic molecular-beam sampling system, *Internal combustion engines, *Chemical composition, *Mass spectrometry, *Test engines, *Gases, Experimental equipment, Oxygen, Reaction kinetics, Pressure.

A supersonic molecular-beam system with a mass spectrometer detector suitable for direct sampling from a cycling-pressure source was developed. Possible applications of this system include general investigations of chemical reaction rates and instantaneous measurement of the gas composition in an engine cylinder throughout the complete engine cycle. When four different binary mixtures were studied with a modified model airplane engine, slip velocity depended strongly on the difference between the masses of the two species. Results for argon-helium mixtures indicate argon enrichments and depletions to be observed respectively near the signal peak and near the end of the cycle. Argon enrichments are perhaps explained by the fact that the high gas flow rates near the top-dead-center piston position cause strong skimmer interferences; argon depletions near the end of the cycle are perhaps caused by relatively strong background scatterings. When the nozzle-skimmer distance decreases, the skimmer interferences tend to decrease the heavy (oxygen) species mole fraction, in contradiction to the results for Ar-He mixtures. Similar trends have been observed for other oxygen-nitrogen mixtures. The main sources of experimental errors include cleanliness of the ionizer plates and baseline changes with signal intensity. (Author abstract modified)
APTIC-23668

### AROMATIC HYDROCARBONS. II. PRESENCE IN THE PARTICULATE PHASE OF GASOLINE-ENGINE EXHAUSTS AND THE CARCINOGENICITY OF EXHAUST EXTRACTS.

A.M.A. Arch. Ind. Hyg. Occupat. Med., vol. 9:164-177, Feb. 1954. 10 refs. (Presented at the Cancer Prevention Committee, New York, Nov 3, 1953.)
Paul Kotin, Hans L. Falk, and Marilyn Thomas.
Identifiers: *Carcinogens, *Engine exhausts, *Polynuclear compounds, Mice, Skin cancer, Soot, Spark ignition engines, Chromatography, Spectrophotometry, Ultraviolet spectrometry, Test engines, Perylenes, Pyrenes, Benzo (3-4)pyrene, Ultraviolet radiation.

Qualitative and quantitative determinations of the exhaust products from gasoline engines were undertaken under varying conditions of engine operation, and extracts of the exhaust-product samples were used in biological carcinogenic studies on C57 black mice. Samples were collected in Lucite filters, extracted by hot redistilled benzene, separated by chromatography on alumina and paper chromatography, and analyzed spectrophotometrically. The ultraviolet absorption spectra of the following polycyclic hydrocarbons were revealed to be present in the soot produced by a gasoline engine: pyrene, 3,4-benzpyrene, 1,2-benzpyrene, 1,12-benzperylene, anthanthrene, and coronene. In addition, an unidentified orange crystalline compound, referred to as Compound X, was isolated and characterized by its absorption spectrum. As the speed of the engines increased, the quantity of hydrocarbons emitted decreased, but maximum production of hydrocarbons varied with individual compounds. Pyrene was produced most at 1500 rpm, while benzpyrene, benzperylene, and anthanthrene gave highest yields at 500 rpm, and Compound X gave a maximum yield at 1000 rpm. The amount of hydrocarbons liberated decreased with an increase in load, while the greated increase in hydrocarbon production was primarily noted during acceleration. Since the determinations were made on a stationary Ford V-8 engine with dynamometer attachment, an equation is provided for extrapolation to traffic conditions. Benzene extracts of the particulate phase of the exhaust products produced skin papillomas and skin cancers when painted on C57 black mice. More than 60% of the tumor-bearing animals bore multiple tumors, with two mice having five individual papillomas and three having four papillomas. Sebaceous gland hyperplasia occurred in five tumor-bearing mice, while a frequent finding was the presence of large spindle-cell components in areas of squamous carcinoma.
APTIC-23669

### AIR POLLUTION CONTROL: HEALTH ASPECTS AND MICROTECHNIQUES.

Trans. N. Y. Acad. Sci., vol. 18:289-297, Feb. 1956. 28 refs. (Presented at the New York Academy of Sciences, Section of Physics and Chemistry, Jan. 3, 1956.)
Leonard Greenburg, and Morris B. Jacobs.
Identifiers: *Air pollution episodes, *Analytical methods, *Measurement methods, *Sampling methods, Health statistics, Smog, Fuels, Fog, Inversion.

While it has been calculated that approximately 1 million tons of sulfur dioxide are given off to the air every year in New York City, the greatest source of air pollution in New York City is burning fuel. Effects of air pollution on health can be placed into two categories: dramatic incidents such as occurred in the Meuse Valley in Belgium (1930), in Donora, Pa. (1948), and in Poza Rica, Mexico (1950); and generalized incidents that recur from time to time, such as the fogs of Lon-

don and the smogs of Los Angeles. Weather conditions at these times were such that a pronounced low-altitude inversion existed. The principle of deposition is useful for sootfall sampling, and glass slides and Petri dishes are used on occasion for the collection of settled particulate matter from the air. Absorption methods consist mainly of the types using impingement and the types using absorbers such as fritted bubblers. High-volume samplers, automatic filter-paper samplers, and millipore filters have also been developed for air pollution studies. Samples can be collected by the use of condensation as well as adsorption. Sulfur dioxide can best be analyzed by the peroxide method, while sulfur trioxide may be estimated as acid by direct titration or gravimetrically as barium sulfate. The infrared spectrophotometic method is the choice for carbon monoxide determination, and the nitrogen oxides are converted to nitrates and estimated by the phenoldisulfonic acid method. Methods of analysis are also indicated for ammonia, aldehydes, cyanides, fluorides, ozone, hydrogen sulfide, lead, and hydrocarbons.
APTIC-23671

### USE OF MOLYBDATES FOR ESTIMATING AMOUNT OF OLEFINIC-TYPE HYDROCARBONS IN AIR.

Anal. Chem., 26 (1):221-225, Jan. 1954. 22 refs.
Robert D. MacPhee.
Identifiers: *Colorimetry, *Olefins, *Molybdenum compounds, Los angeles, Experimental methods, Sodium compounds, Temperature.

A sodium molybdate reagent in strongly acid medium was developed to give a maximum sensitivity towards olefins. When gaseous olefins were tested with this new reagent, data for 1-butene and 1-hexene showed that the color intensity for the olefins conformed to Beer's law. Rather than merely allowing the reaction to proceed at room temperature, reproducibility of results was better when the test was carried out at 60 C. Phosphomolybdic acid can be substituted for sodium molybdate, and in several tests a peak absorption at 685 millimicrons was exhibited regardless of whether phosphomolybdic acid or sodium molybdate was used. However, varying the palladous sulfate or molybdenum concentrations from the optimum specified was found to produce radical changes in relative color intensities for straight-chain olefins with respect to branched-chain and cyclic olefins. With the exception of isobutylene, the various olefins tested were found to have extinction coefficients between 59 and 145. Air samples were drawn through 20- to 30-mesh Ascarite and collected in freeze-out traps using liquid oxygen refrigerant, while analyses were made for $C_3$ and heavier olefinic-type hydrocarbons in the air of Los Angeles. The olefin content of the air was greater as a rule in the early morning than in the late morning and afternoon. A weight ratio of olefins to carbon monoxide of 0.075 was observed from analyses of automobile exhaust gases under average driving conditions in Los Angeles. (Author summary modified)
APTIC-23673

### PROBLEMS IN THE MEASUREMENT OF ATMOSPHERIC SOOT. CRITIQUE OF A RECOGNIZED MEASURING PROCEDURE.

(Fragen der Russmessung. Kritik eines bekannten Messverfahrens). Text in German. Oel Gasfeuerung, vol. 13:14, 16, 18, 20, 1968.
Lothor Heyne, and Karl August Werthof.
Identifiers: *Soot fall, *Colorimetry, Germany, Soot, Fuel oils, Measurement methods, Samplers, Sampling probes, Benzo (3-4)pyrene.

A quantity of the test gas is pumped through a special filter paper (as prescribed in ASTM 2156) at the rate of 5750 ml per square centimeter of filter paper surface. The soot contained in the air sample causes a darkening of the paper. The degree of grayness is determined and read on the Bacharach scale, and from this value, the soot content of the air can be determined. Differences in the values obtained in a series of tests were attributed to differences in the manner of taking samples. The original Bacharach tests made use of a hand pump, equipped with a probe 6 mm in diameter and held perpendicular to the flow of waste gases. The results obtained here were with the use of a motorized pump, using a probe 1.5 m in length and with a smaller diameter of 12 mm, and this was pointed in a direction opposite to the flow of gases. Deviations from the original testing program were not as great for fine soot particles as for larger particles. The practical implications of this are discussed. The increased use of fuel-oil heat sources presents problems, in that the smoke from oil burners tends to be more aggressive than that derived from the burning of coal. It tends to be more destructive of construction materials, and the soot itself contains a higher content of carcinogenic substances, such as 3,4-benzopyrene.
APTIC-23675

### PAINT INDUSTRY SMOG CHAMBER. 3. FINAL TECHNICAL REPORT ON THE ROLE OF SOLVENTS IN PHOTOCHEMICAL-SMOG FORMATION.

National Paint, Varnish, and Lacquer Assoc., Inc., Washington, D. C., Technical Div., Circ. 799, 46p., April 1970. 12 refs.
Arthur Levy, and Salo E. Miller.
Identifiers: *Eye irritation, *Smog, *Solvents, *Exposure chambers, State governments, Regulations, Standards, Emission standards, California, Oxidants, Measurement methods, Formaldehydes, Esters, Ethers, Aromatic hydrocarbons, Ketones, Azines, Nitric oxide (no), Photooxidation, Visible radiation.

The principal solvent regulations in existence stem from the State of California, namely, Los Angeles' Rule 66 and San Francisco's Regulation 3. The criteria used to establish these regulations have been primarily related to eye irritation and to oxidant formation. Los Angeles currently defines a day of photochemical smog as one in which the average oxidant level is 0.10 ppm for 1 hour. Although these two rules are quite definitive in restricting the types of solvents that may be emitted to the atmosphere in these localities, the basis for arriving at the restrictions is not always well substantiated. An effort was needed, therefore, to classify many more organic materials than are specifically spelled out in these regulations and to define the reactivity of organic solvents more explicitly. This program was pursued by carrying out smog-chamber experiments wherein solvent materials were photooxidized under simulated sunlight-atmospheric conditions and the solvents evaluated in terms of eye-irritation measurements and chemical reactivity parameters. One hundred fifty-four smog-chamber runs were conducted in this program. Forty-five individual organic-solvent materials were examined under a specific set of smog-chamber conditions-namely, 4 ppm organic and 2 ppm nitric oxide. Concentrating principally on four reactivity parameters, $NO_2$ t-max, oxidant formation, eye-irritation response time, and formaldehyde production, it was possible to render some specific and general evaluations of the photochemical-smog-forming tendencies of these materials. Although there is evidence that Rule 66 may be overly stringent with respect to certain solvents, data obtained in this program tend to confirm the basis upon which Rule 66 and Regulation 3 were derived. This program has shown that the ketones in general are much less reactive with respect to eye irritation than originally suggested by the California studies. For this criterion, it has been shown that there may be less structure dependency than one might have anticipated earlier; in the case of aromatic hydrocarbons, on the other hand, reactivity may be quite dependent on structure Mineral spirits may be controlled at a lower aromatic content than necessary, and certain aromatic hydrocarbons do not appear to be as reactive as Rule 66 might imply. From a research point of view, a number of interesting observations have been brought out which should have some bearing on how regulatory agencies may act in the future. The effects of organic/nitric oxide ratios, for example, are probably sufficiently diverse that one should consider the dangers of establishing reactivity scales strictly on a fixed organic/nitric oxide ratio.
APTIC-23676

### BACTERIAL AIR POLLUTION ASSOCIATED WITH THE SEWAGE TREATMENT PROCESS.

For primary bibliographic entry see Field 01.
APTIC-23680

### A REPORT TO DEPARTMENT OF HEALTH, EDUCATION AND WELFARE OF OPTICAL MEASUREMENTS OF $SO_2$ AND $NO_2$ AIR POLLUTION USING BARRINGER CORRELATION SPECTROMETERS.

NAPCA Contract PH-22-68-44, Barringer TR-69-113, 192p., Dec. 1969. 8 refs. CFSTI: PB-193485
Personal Author Not Recorded.
Identifiers: *Spectrometry, *Nitrogen dioxide (no2), *Sulfur dioxide, Stack gases, Aerosols, Smog, Boilers, Stacks, Continuous monitoring, Stack sampling, Inversion, Nitric oxide (no), Photooxidation, Light radiation, Light scattering.

Research on the application and evaluation of a new measurement technique based on correlation spectrometry is described wherein a portion of the desired spectrum containing rotation-vibration band structures is compared against a stored replica of the sought spectral signature contained within the spectrometer, thereby generating a real time readout of the quantity of target gas within the field of view of the instrument. Tests on boiler stacks show that the in-stack moniter can be used successfully for the continuous monitoring of the sulfur dioxide content of flue gases. The airborne correlation spectrometer is used to study the oxidation of nitric oxide emissions to nitrogen dioxide downwind of the stack. Field tests in southern California indicate that the concentrations of $NO_2$ vary considerably from point to point. Aerosol scatter and optical dilution by the California smog enhance the amount of backscattered radiation returned from the upper layers of the inversion, thereby decreasing the sensitivity of the instrument. (Author summary modified)
APTIC-23681

### ACTIVITIES OF THE NASA-SPONSORED SRI TECHNOLOGY APPLICATIONS TEAM IN TRANSFER OF AEROSPACE TECHNOLOGY TO THE PUBLIC SECTOR.

Contract NASw-1992, NASA Rept. CR110238, SRI Quarterly Progress Rept. 2, 61p., 1970.
CFSTI: N70 30531
Personal Author Not Recorded.
Identifiers: *Analytical methods, *Measurement methods, Trees, Mining, Primary metallurgical processing, Open burning, Solid waste disposal, Dumps, Control methods, Fluorides, Beryllium compounds, Ozone.

In reporting a continuing program of aerospace technology transfer to the public sector, problems are reported in three principal categories; air pollution, criminalistics, and transportation. In the air pollution category, problem statements no. 10-16 are presented. These include the need for a rapid inspection technique to test compliance of motor vehicles with emission standards; a monitor for atmospheric fluorides; a method for disposal of waste wood; stabilization of mine and smelter waste piles; an instrument to measure atmospheric ozone; a monitor for atmospheric beryllium; and a sulfuric acid mist collector. The results of computer searches for relevant material for these and nine previously submitted air pollution problems are included. Reports of contact with user organizations include five reports of visits to west coast air pollution control organizations for the purpose of explaining the services offered and obtaining preliminary statements of problems. Two program problems are discussed, the variation among reference reviewers' opinions of the

relevancy of specific references to a given problem, and the failure of the computer searches to find relevant references.
APTIC-23683

### CONTINUOUS DETERMINATION OF NITRIC OXIDE IN AUTOMOTIVE ENGINE EXHAUST.

Coordinating Research Council Proj. CM-59-65,
Rept. 416, 19p., June 1968. 1 ref.
Personal Author Not Recorded.
Identifiers: *Engine exhausts, *Continuous monitoring, *Infrared spectrometry, *Nitric oxide (no), Hydrocarbons, Nitrogen dioxide (no2).

A beckman and an MSA nondispersive infrared nitric oxide analyzer are evaluated for use in continuous determination of nitric oxide in exhaust streams. Instrument performance is judged in terms of stability and speed of response to typical components of automotive exhaust mixtures. Under proper experimental conditions both instruments perform satisfactorily from standpoints of stability and speed of response. Interferences from exhaust components introduce unavoidable error in the measurement of nitric oxide present in samples with low nitric oxide-to-hydrocarbon ratio, for example, exhaust produced by idling engine. In composite samples produced over a typical engine cycle, the total interference effect amounts to a negligible fraction of the sample's nitric oxide content. Results from continuous measurements of nitric oxide in exhaust streams correlate excellently with results obtained from parallel analyses of respective integrated samples by the static tank oxidation method. Nondispersive infrared nitric oxide analyzers could be applied in conjunction with nitrogen dioxide analyzers on exhaust samples with partially oxidized nitric oxide (into nitrogen dioxide) without introducing a serious error as a result of the sample modification that possibly accompanies oxidation of nitric oxide into nitrogen dioxide. For maximum accuracy it is recommended that the analyzers be zeroed and calibrated frequently, interferences from carbon monoxide and carbon dioxide be taken into consideration, and the results be corrected for lack of linearity of response to nitric oxide. (Author summary modified)
APTIC-23687

### LIDAR OBSERVATIONS OF THE LOWER TROPOSPHERE DURING BOMEX.

For primary bibliographic entry see Field 05.
APTIC-23691

### AIR ION MEASUREMENT.

American Inst of Medical Climatology,
Philadelphia, Pa., Proc. Intern. Conf. Ionization
Air, Philadelphia, Pa., 1961, 1 (3): 15p. 26 refs.
John C. Beckett.
Identifiers: *Ions, *Particle counters, Portable, Particle size, Design criteria, Flow rates, Density.

In the study of biological and physiological response to air ions, it is even more important that complete information on ion density, ion size distribution, and ion fluctuations be recorded for careful evaluation. Size and shape of the ion collector will depend on the selection of air velocity, polarizing potential, and ion mobility range to be measured. A practical design limit is a collector which will provide an ion current of 100,000 ions/sec for a sensitivity of 20 ions/cc. The Ebert counter, the Wesix unit, and the Schmeer ion counter are discussed. Aging of ions is a function of contaminants present in the air, absolute humidity, temperature, and barometric pressure. A portable small ion counter was built in Munich and is complete with dc amplifier and battery power for the blower, collector and amplifier. This type of instrument can be of great value to the air conditioning engineer. A patented target collector which measures small ion rate of flow from ion sources is particularly useful in the laboratory for research on bacteria, tissue and plant cells.
APTIC-23702

### CALIBRATION OF THE HIGH-VOLUME AIR SAMPLER.

Am. Ind. Hyg. Assoc. J., 30 (1):83-88, Jan.-Feb.
1969. 6 refs.
D. R. Lynam, J. O. Pierce, and J. Cholak.
Identifiers: *Calibration methods, *Flow rates, *Hi-vol samplers, Particulate sampling, Filters, Electrical resistance, Voltage.

Two methods for varying the air flow through a high-volume particulate sampler during calibration are evaluated: use of either a variable voltage transformer (Variac) or of resistance in the form of resistance plates, or filter media. Calibration curves obtained with a bellows-type dry gas meter and a rotating vane anemometer show that the Variac method cannot be used without appreciable error unless certain requirements are met, and clearly illustrate that resistances should be used as the standard procedure for varying the flow rate during calibration of the Staplex high-volume sampler. A simplified calibration procedure is described utilizing a rotating vane anemometer at the sampler inlet. (Author abstract modified)
APTIC-23705

### MEASUREMENT OF JET ENGINE COMBUSTION TEMPERATURE BY THE USE OF THERMOCOUPLES AND GAS ANALYSIS.

Preprint, Society of Automotive Engineers, Inc.,
New York, 19p., 1969. 19 refs. (Presented at the
National Air Transportation Meeting, New York,
April 21-24, 1969, Paper 690433.)
R. C. Williamson, and C. M. Stanforth.
Identifiers: *Jet aircraft, *Gas chromatography, *Thermocouples, Engine exhausts, Measurement methods, Air-fuel ratio, Calibration methods, Temperature sensing instruments, Hydrocarbons, Hydrogen, Nitrogen, Carbon monoxide, Oxygen, Combustion.

The measurement of jet engine combustion temperature is accomplished principally by the use of either thermocouples or gas analysis. Although more tedious, gas analysis is required to measure the highest temperature levels such as in afterburners, while thermocouples are normally adequate to measure the exit temperatures from main combustors. The measurement techniques are presented and determination of the true temperature is described, along with the errors which are involved in each case. Advantages and limitations of the methods are discussed, and criteria are presented to aid in the selection of the best method for a particular application, which should be based upon such factors as cost, ease of installation, response time, data acquisition time, simplicity of data reduction, temperature range, and accuracy. At temperatures up to 2000 F, chromel-alumel thermocouples satisfactorily meet the above requirements. For temperatures up to 2800 F, coated platinum/ platinum rhodium thermocouples are suitable. The (Pt 30% Rh)/ (Pt 6% Rh) combination is a very promising thermocouple for these temperatures. Gas analysis may be a contender in this range. For temperatures above 2800 F, gas analysis has been more satisfactory than thermocouple measurements. Hydrogen, oxygen, nitrogen, carbon monoxide, and unburnt hydrocarbons can be analyzed by gas chromatography. Air fuel ratio and combustion efficiency are measured with oxygen analyzers.
APTIC-23722

### STANDARD SMOKE MEASUREMENT METHOD.

Preprint, Society of Automotive Engineers, Inc.,
New York, 5p., 1970. (Presented at the National
Air Transportation Meeting., New York, April 20-
23, 1970, Paper 700250.)
G. P. Sallee.
Identifiers: *Aircraft, *Spot tests, *Smokemeters, Engine exhausts, Smokes, Engine operating cycles, Measurement methods, Sampling methods, Membrane filters, Sampling probes, Air-fuel ratio.

Details of the development, apparatus, and procedures are given for a standardized method to measure smoke emission from aircraft engines. Testing was conducted in both increasing and decreasing sequences with sufficient smoke samples being taken to cover all combinations of the following: sample rate - 0.0041, 0.0085 standard cu ft/sec; sample size - 0.002-0.115 lb/sq in. of surface area; filter material - Millipore SM or Whatman no. 4; and engine power - idle, approach, cruise, takeoff. The precise location of smoke sampling probes, temperature and pressure measurement locations and test cell engine, line and control room orientations, as well as the parametric changes used to evaluate the method, are given. In over 500 actual data points taken during development testing, each of the smoke filter spots was measured for optical density on three different types of optical densitometers and the actual volume of gas that passed through each filter sample was calculated along with engine fuel-to-air ratios. These data, after plotting and analysis, will be published as the basis of the final SAE method standard.
APTIC-23728

### ELECTRO-OLFACTOGRAM TECHNIQUE AND INTERPRETATION.

Randomline, Inc., Willow Grove, Pa., ONR
Contract N0014-69-C-0181, 16p., Nov. 1969. 9 refs.
CFSTI, DDC: AD 705520
Allan H. Frey.
Identifiers: *Electro-olfactograms, Laboratory animals, Potentiometric methods, Odorimetry, Microscopy, Exposure chambers.

Experiments bearing on the controversy regarding the interpretation of the electro-olfactogram are reported, in which frog olfactory receptor tissue was examined microscopically after exposure in an experimental chamber to either odorized or ambient air. The technique incorporated new controls, involving laminar airflow conditions and care in identifying and patterning the electrostatic environment that earlier work had indicated to be necessary in EOG studies. Three different patterns of EOG could be obtained from the same preparation as a function of the controls used. The classic negative voltage response was obtained when the olfactory receptor tissue was exposed to the classic high velocity puff of odorized air without the new controls. A slowly developing negative voltage response to odorized air was obtained when the tissue was exposed to low velocity but not laminar flowing odorized air. In contrast, a biphasic wave with a large initial positive component was obtained when laminar flowing air was used and the electrostatic environment was controlled. Placement of the electrode in non-olfactory tissue as a control indicates that the latter effect is not electrochemical. Thus it appears that much of the controversy in the olfactory literature may result in part from the use of a classic though unreliable stimulated technique as well as from possible confounding of several effects in the past literature. (Author abstract modified)
APTIC-23755

### THE NEW YORK STATE CONTINUOUS AIR QUALITY MONITORING SYSTEM.

New York State Dept. of Health, Albany, Div. of
Air Resources, Rept. BARD-2, 11p., Jan. 27, 1969.
7 refs.
Donald E. Gower.
Identifiers: *Air quality measurement programs, *New york state, *Continuous monitoring, Survey methods, Alerts, Air resource management, State governments, Oxidants, Soiling index, Flame ionization detector, Colorimetry, Samplers, Computers, Data-handling systems, Winds, Humidity, Rain, Snow, Pressure (atmospheric), Temperature (atmospheric), Aldehydes, Hydrocarbons, Carbon monoxide, Nitric oxide (no), Nitrogen dioxide (no2), Sulfur dioxide.

The State of New York is among the first to install and operate a Continuous Air Quality Monitoring System for measurement of eighteen air pollution parameters over the large geographical area en-

compassed by the State. The objective of the system is to aid the New York State Department of Health's Division of Air Resources in managing and improving the air environment to protect the people's health. This objective will be achieved by continuously monitoring the State's air parameters and providing reports which will be used to determine the air quality level. For instance, the monitoring system provides data that is used to evaluate the status criteria for the 'High Air Pollution Alert and Warning System'. Each monitoring station sends data to the central office computer every fifteen minutes by telephone lines. The collected data will be processed by computer and visually displayed for use at a report rate which is 'effectively real time'. At present, ten monitoring stations are becoming operational and provide valuable air quality data. Expansion of this system to fifty stations is planned over the next few years. The latest advances in air pollution instrumentation, electronic data transfer, and data processing techniques used in the Continuous Monitoring System are discussed in detail. Particular emphasis is placed on the electronic systems and techniques that play a vital role in today's environmental engineering programs. Sulfur dioxide, nitric oxide, nitrogen dioxide, aldehydes, and oxidants are detected by colorimetric methods. Carbon monoxide is sensed by infrared absorption. The concentration of hydrocarbons is determined by the flame ionization method. Meteorological data, include wind speed, radiation, pressure, humidity, temperature, rain, and snowfall are also obtained. Soiling is measured by a papertape sampler. (Author abstract modified)
APTIC-23762

### CONTINUOUS AIR QUALITY MONITORING IN NEW YORK STATE.

Preprint, 7p., 1969. 1 ref. (Presented at the
Technicon International Congress, Chicago, Ill.,
June 4-6, 1969.)
Donald C. Hunter.
Identifiers: *Air quality measurement programs, *New york state, *Continuous monitoring, Survey methods, State governments, Oxidants, Soiling index, Flame ionization detector, Computers, Data-handling systems, Infrared spectrometry, Meteorology, Aldehydes, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Sulfur dioxide.

Governor Rockefeller approved legislation in 1966 making it possible to expand air quality monitoring in New York State. Continuous monitoring, with telemetry linking the remote stations to a time-sharing computer and a data reception center in Albany, was chosen as the most practical means of implementation. A 50-station network of primary continuous monitors, augmented by some 300 satellite stations (either small continuous monitors or intermittent manual sampling stations), was planned. The objectives of the network would be: (1) to determine general levels of air pollution and improvements with respect to time, (2) to serve as part of a statewide Alert and Warning System, and (3) to provide data for correlation with effects on the various receptors. After thorough study, continuous wet chemistry instrumentation, using nationally established, well recognized standard procedures with high accuracy and relative freedom from interferences, was specified for determination of sulfur dioxide, nitrogen oxides, aldehydes, and oxidants. Infrared absorption was specified for carbon monoxide, hydrogen flame ionization for total hydrocarbons, and reflectance measurement for soiling. The stations were also designed for continuous measurement of various meteorological parameters. Nine of the first eleven primary stations are on site. The job has not been without problems. Current philosophy of regional control of air pollution emphasizes the need for instrumentation of high accuracy, specificity, and durability. Design of each instrument as a completely integrated system appears to be the direction toward which all instrument manufacturers should strive. (Author abstract modified)
APTIC-23764

### A NEW INSTRUMENT FOR THE MEASUREMENT OF GASEOUS FLUORIDES TO LESS THAN ONE PART PER BILLION.

Preprint, Leigh Instruments Ltd., Carleton Place
(Ontario), 11p., 1969. (APCA Paper 69-119.)
Harry Brown.
Identifiers: *Colorimetry, *Automatic methods, *Fluorides, Canada, Continuous monitoring, Photometric methods.

An automated fluoride analyzer is described that will collect continuous air samples for a week and permit gaseous fluorides to be determined in the low ppb range, for which some states have already issued regulations. The method used by the instrument is an extension of the coated-tube method, where a tube coated with sodium carbonate collects the gaseous fluoride for subsequent detection by colorimetric analysis. A sodium carbonate solution is automatically pumped to one pipette and modified megregian colorimetric solutions to two other pipettes. After the pipettes are filled, a valve releases the sodium carbonate through the absorber tube and an air pump draws in air through a heated intake tube. Measurements are derived by washing the absorber tube with the colorimetric solution and then, to obtain a reading, comparing this tube with a duel cell photometer supplied with colorimetric solutions that have not been exposed to fluorides. Concentrations are measured in microgram F/cu m as a function of time, and two hour sampling periods are recommended for levels in the very low ppb range.
APTIC-23767

### RADIOACTIVE LABELLING OF MEMBRANE FILTERS FOR THE ASSAY OF AIR-BORNE MATERIAL.

Nature (London), 187 (4741):930-931, Sept. 10,
1960. 7 refs.
G. Kubie, and K. Spurny.
Identifiers: *Membrane filters, *Radioactive tracers, Czechoslovakia, Aerosols, Dusts, Adsorption, Nickel compounds, Isotopes.

Quantitative assessment of airborne material with membrane filters is considered, by converting the filters themselves into a radiation source used for thickness gauging, thereby eliminating the effect of filter thickness from measurement. Initial work was performed by adsorbing radioactive nickel or thallium salts from solution upon the filter surface. With an effective filter area of 1 sq cm, absolute air volumes of 10-300 liters are sufficient to obtain deposits suitable for the assessment of high and medium dust concentrations. The lower limit of sensitivity is at present 1.6 mgm/sq cm and 6.0 mgm/sq cm for filters labelled with nickel and thallium, respectively. Filters of this kind were used for estimating the concentration of solid aerosols and industrial dust of constant composition.
APTIC-23770

### NEW EQUIPMENT AND TECHNIQUES FOR SAMPLING CHEMICAL PROCESS GASES.

J. Air Pollution Control Assoc., 13 (4):162-166,
April 1963. 7 refs. (Presented at the Air Pollution
Control Association, 55th Annual Meeting,
Chicago, May 20-24, 1962.)
W. F. Patton, and J. A. Brink Jr.
Identifiers: *Samplers, *Dusts, *Mists, Portable, Chemical processing, Particle size, Particulate sampling, Cascade samplers, Centrifugal separators, Filters, Nitric acid, Phosphoric acid, Sulfuric acid, Ammonium chloride, Mercury compounds, Nitrates, Phosphates.

When the need for improved sampling equipment and techniques was recognized at Monsanto a number of years ago, a cascade impactor suitable for adiabatic measurements on process gases was developed. Simpler equipment, suitable for routine control of air pollution, can determine accurately the weight or chemical composition of the particles in a gas stream, as well as separately determine the loading of particles greater than three micron in diameter from particles smaller than this. The dust or mist sampling device is contained in a small case with a carrying handle and removable sides similar to an Orsat analyzer. Gases first enter the cyclone where the larger particles are collected, while the smaller particles are carried over and collected by the filter. Sampling preparations are discussed for large particles, fine particles, and isokinetic sampling. The procedures for sampling are outlined, as well as an example for sulfuric acid mist. Calculations of loadings from sampling data are also indicated. Eight sets of the sampling equipment have been utilized for sulfuric, phosphoric, and nitric acid mists, mercury mist, various phosphate salt dust, ammonium chloride fume, ammonium nitrate fume, and several organic mists.
APTIC-23771

### THE CASCADE IMPACTOR: AN INSTRUMENT FOR SAMPLING COARSE AEROSOLS.

J. Sci. Instr., vol. 22:187-195, Oct. 1945. 18 refs.
K. R. May.
Identifiers: *Aerosols, *Cascade samplers, Great britain, Spores, Sprays, Droplets, Mists, Pollens, Pesticides, Particle size, Particulate sampling, Design criteria, Experimental methods, Microscopy, Clouds, Fog.

A new instrument is described which will sample large particles in windborne and stationary aerosols such as natural fogs and clouds, fine sprays, insecticidal mists, coarse dusts, and pollen and spores. By means of four progressively finer jets impinging on glass slides in series, the sample is split up into size-graded fractions in a form suitable for microscopic analysis. The greatest efficiency of sampling is achieved for particles in the range 50 micron-1.5 micron diameter. The size-grading greatly facilitates the detailed microscopic examination of heterogeneous samples and in some cases enables approximate size-distributions to be obtained by bulk estimations of the samples without the need for microscopic sizing. Experimental results fof the efficiency of jets in impacting particles are correlated by dimensional analysis, and a parameter of general applicability for estimating impaction efficiencies of jets is derived. Descriptions are given of various microscope slide treatments for sampling volatile droplets: included are the plain-glass method, 'absolute' method (in which the drops are totally enclosed in an appropriate matrix), magnesium oxide method of analyzing the pit which droplets leave when impacted, and the stain method. The counting technique required by impactor samples is described in detail, as well as bulk estimation of samples applicable in such cases as fine sprays where the size distribution is bracketed by the four slides on the impactor. (Author abstract modified)
APTIC-23787

### RESEARCH PROJECT 'TRANSVERSE JET PLUMES.' (TECHNICAL PROGRESS REPORT).

New York Univ., N. Y. Geophysical Sciences
Lab., AEC Contract AT (30-1)-3673, NYU GSL
TR-67-8, 23p., 1967. CFSTI: NYO-3673-2
James Halitsky, Irving Karmin, and Stanley Liu.
Identifiers: *Wind-tunnels, *Plume behavior, Potentiometric methods, Sampling probes, Computer programs, Design criteria, Simulation, Testing facilities, Flow rates.

The construction and testing is reported of turbulence-generating vanes that will be used to create a horizontally-oscillating air stream at the mid-height of a wind tunnel. The stream will serve as background flow for transverse jet plumes. The vane mechanism does not provide for a continuous spectrum of the vertical component of turbulent atmospheric velocities but rather for a concentration of energy at a single frequency. The wave form producing the most useful frequencies is imposed on the vane mechanism by a cam rotating at constant speed and activating a lever that controls the sliding contact on the vane drive motor potentiometer. Measurements of the mean and turbulent velocities in the jet will require that the probe be positioned and oriented so that its axis is tangent

to the streamline through the point under investigation. This is to be accomplished by a remote potentiometer that will also provide readouts of the measurements. A re-recording system will prepare magnetic tape records of fluctuating atmospheric and tunnel wind velocities for spectrum analysis. A computer model has been worked out for the simple case of long-period azimuthal oscillations where the concentration distribution in the plume may be considered to shift laterally without distortion as the plume oscillates. If a vertical oscillation exists, the plume configuration will change as the wind component into and out of the top of the stack varies in magnitude as well as in size.
APTIC-23795

### DESIGN, FABRICATION, TESTING AND EVALUATION OF A CHEMILUMINESCENT OZONE METER. (FINAL REPORT).

Research Triangle Inst., Research Triangle Park,
N. C., Engineering and Environmental Sciences
Div., NASA Contract Nas1-9256, NASA CR-
66913, 97p., Feb. 1970. 6 refs. CFSTI: N70-26598
J. B. Tommerdahl.
Identifiers: *Continuous monitoring, *Ozone, *Fluorescence, Operating variables, Calibration methods, Design criteria, Instrumentation, Chlorine, Pressure.

A comprehensive engineering description is given of the design, construction details, calibration techniques, and operational characteristics of an ozone meter based on chemiluminescence specific for ozone. The basic elements of the system are the chemiluminescent disc and photo-detector assembly. The gases to be sampled are metered at a constant flow rate of 600 ml/min through the disc chamber. The emitted light resulting from the reaction of ozone with the chemiluminescent material is monitored by the sensitive photomultiplier tube. Push-button actuated modes for 'run' or 'calibrate' are available for continuous operation in either cycle, and an 'external' mode is provided for remote control of the operational mode. Instrument specifications are as follows: dynamic range, 1 pphm to 10 ppm; resolution, 0.1 pphm; minimum detectable level, 1 pphm; precision, 2%; accuracy, plus or minus 10% at time of calibration; stability, primarily dependent on disc characteristics and sample air composition, calibration, nominal range 20-30 pphm, internally adjustable 0-20 pphm; output, front panel meter-0-10 units, recorder - 1 volt FS, maximum rated output - 5mA. Results are given of special tests to determine the effect of chlorine and the operation and calibration at reduced pressures (10 psi).
APTIC-23802

### PRIME NEED: INSTRUMENTS FOR USE IN FIELD.

Power, 114 (10):50-53, Oct. 1970.
Rene J. Bender.
Identifiers: *Analytical methods, *Instrumentation, Sewage, Water pollution, Polarographic methods, Potentiometric methods, Chromatography, Gas chromatography, Spectrophotometry, Photometric methods, Turbidimetry, Flowmeters, Mass spectrometry, Sulfur dioxide.

As demand for pollution control has increased, so has the need for adequate instrumentation. Analyses previously performed by wet chemical methods are gradually being replaced by solid state methods: chromatography, spectrophotometry, atomic absorption, and polarography. Accurate calibration of sensitive instruments is of great importance, particularly where constituents of nuclear origin are measured. Gas chromatography, mass spectrometry, infrared spectrophotometry, ultraviolet absorption, and electronic sensing are defined for monitoring and controlling air pollution. A flame photometric detector is being developed to measure sulfur dioxide in the air. Air-pollution surveillance of a large metropolis is illustrated by the system in effect in New York City. Monitoring instruments for water management include pH meters; turbidity indicators; dissolved solids recorders; dissolved oxygen, biological oxygen demand and chemical oxygen demand meters; oxidation-reduction potential sensors; and chloride ion analyzers. Thermal pollution can be surveyed over a large area with an infrared camera, while the carbonaceous analyzer is for rapid measurement of organic material in water. Atomic absorption can be used for detection and analysis of metallic elements in solution. Flowmeters, ordinarily of the venturi type, measure sewage quantity entering the plant, while most other instruments and functions are confined to the sewage treatment plant laboratory. Noise control measures and telemetry are also mentioned.
APTIC-23810

### AEROSOL SAMPLER ARRANGEMENT AND PUMP THEREFOR.

(AAI Corporation, Cockeysville, Md.) U. S. Pat.
3,523,001. 6p., Aug. 4, 1970. 10 refs. (Appl. July 30,
1968, 11 claims).
David Sylvester, Barron W. Mouring, and Henry
J. Ulrich Jr.
Identifiers: *Aerosols, *Samplers.

The invention described provides an aerosol sampling arrangement that yields positive air displacement at a known flow rate, and with low noise level in operation. The first two features are general requisites for aerosol sampling, the third is highly desirable in some major applications. The sampler is characterized by a valveless air pump with a removable contaminant-collecting filter connected to its intake side. The pump has a disc piston which is tilted to make an effective seal with a cylinder bore in the exhaust stroke direction and to form a bypass about the piston during the return piston stroke. Tilting is effected by a crank arm having its axis of rotation off-center from the piston bore axis. Effective seal and bypass operation of the disc piston is materially enhanced by a flexible piston skirt with gas ports that are alternately substantially blocked and opened by the tilting motion of the piston. (Author abstract modified)
APTIC-23817

### NBS DETECTOR TUBE METHOD FOR CARBON MONOXIDE (CO) IN AIR.

Preprint, Robert A. Taft Sanitary Engineering
Center, Cincinnati, Ohio, Technical Assistance
Branch, 3p., 1961. 6 refs.
F. A. Bell Jr.
Identifiers: *Carbon monoxide, *Colorimetry, Calibration methods.

A hand sampling method is described which is applicable in approximating carbon monoxide concentrations in the open atmosphere in order to arrive at relative CO concentrations under differing degrees of general pollution. Air is sampled through CO detector tubes containing indicating gel (purified silica gel impregnated with a sulfuric acid solution of ammonium molybdate and palladous sulfate) between two layers of guard gel, (purified silica gel) all held in by fiberglass plugs. The indicating gel turns uniformly from yellow to blue green in five detectable color stages. Nitrogen dioxide interferes but not significantly in atmospheric concentrations. Carbon monoxide detecting sensitivity is reduced at low temperatures. Notes on calibration and operation are included.
APTIC-23857

### A METHOD FOR SAMPLING THE INSTANTANEOUS CHEMICAL COMPOSITIONS IN AN INTERNAL-COMBUSTION ENGINE.

Preprint, California Univ., Los Angeles, Dept of
Energy and Kinetics, 31p., 1970. 24 refs.
W. W. Young, W. E. Rodgers, C. A. Cullian, Y. G.
Wang, and E. L. Knuth.
Identifiers: *Mass spectrometry, *Chemical composition, *Internal combustion engines, Engine exhausts, Gas sampling, Calibration methods, Test engines, Propanes, Nitrogen, Carbon dioxide, Oxygen, Water.

The feasibility of using molecular-beam techniques and a mass spectrometer for sampling the instantaneous chemical compositions in an internal combustion engine is demonstrated. In this sampling procedure, the gas mixtures in the engine cylinder are expanded as a free jet via a small orifice into a vacuum chamber. The core of the free jet is skimmed and collimated to form a molecular beam. The densities of the several species on the beam are measured as a function of time during the engine cycle by a quadrupole mass spectrometer. The instantaneous temperature and pressure are measured during the sampling period. The study is run on a single-cylinder 2HP engine. Species densities are presented qualitatively for nitrogen, oxygen, water, carbon dioxide, and propane. The results of the test are discussed, and future activities are elaborated. (Author abstract modified)
APTIC-23869

### RADIOACTIVE AEROSOL SIZE CLASSIFICATION EXPERIENCE WITH A LOW PRESSURE CASCADE IMPACTOR.

Harvard Univ., Cambridge, Mass., Air Cleaning
Lab. and Atomic Energy Commission,
Washington, D. C., Div. of Reactor Development
and Technology, Atomic Energy Commission Air
Cleaning Conf. 10th, New York, 1968, p. 263-311.
19 refs. (Aug. 28, Paper CONF- 680821.)
G. W. Parker, H. Buchholz, and W. J. Martin.
Identifiers: *Aerosols, *Cascade samplers, Particle size, Radioactive radiation, Pressure.

Aerosol particles in the submicron range are expected to be released from overheated reactor fuel materials as indicated in numerous experiments which simulate reactor accidents resulting from a loss-of-coolant. Devices to measure aerodynamic particle size in the submicron region are therefore required and a simple, passive, nearly fool-proof device is particularly desirable. An improvement on a standard instrument, an inertial impactor, which operates at subatmospheric pressure thereby increasing both the mean free path of the air molecules and the Cunningham correction (for the slip of small particles between gas molecules) was conceived and investigated to test this principle. A commercially available Andersen Impactor was first successfully modified for low pressure operation to extend its range to submicron sizes and then an impactor of original design was built, tested and calibrated. The useful range of the new instrument was found to be from less than 0.01 micron to several microns particle diameter. The range is variable and is dependent upon the selected operating pressure. The impactor is assembled and disassembled quickly and employs throw-away impactor plates to facilitate radiochemical analysis and decontamination. In several fuel meltdown experiments, aerosol particle sizes, chemical identification and associated radioactivity were determined and size comparisons were made by electron microscopy. The ease of particle measurement by this device has contributed an extra benefit in terms both of the characterization of chemical forms of airborne radioactivity as well as to a simple model of aerosol formation and agglomeration. (Author abstract modified)
APTIC-23877

### A COMBINED POLLUTION INDEX FOR MEASUREMENT OF TOTAL AIR POLLUTION.

J. Air Pollution Control Assoc., 20 (10):653-659,
Oct. 1970. 19 refs.
Lyndon R. Babcock Jr.
Identifiers: *Mathematical analyses, *Air pollution forecasting, Air quality standards, Synergism, Urban areas, Oxidants, Particulates, Oxidant precursors, Electric power production, Operating variables, Jet aircraft, Emission inventories, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Sulfur oxides, Solar radiation.

A method for estimating total air pollution is described and is applied to three examples. The method is called 'pindex' and is based on proposed air quality standards and other generally accepted tenets of air pollution technology. Pindex sums air pollution contributions from particulate matter, sulfur oxides, nitrogen oxides, carbon monoxide, hydrocarbons, oxidant, solar radiation, and particulate-sulfur oxides synergism. Within the pindex method, oxidant is synthesized from nitrogen oxide and hydrocarbon precursors, the degree of conversion being controlled by a solar radiation term. Next, tolerance factors based on air quality standards are used to reduce all the pollutant levels to an equivalent basis. Tolerance factors vary from 214 for oxidant to 40,000 for carbon monoxide. The synergism term is set equal to the concentration of the limiting reactant (sulfur oxides or particulate matter). Finally the six equivalent concentrations plus the synergism term are summed to yield the pindex level. The pindex method is easily revised so that tolerance factors may be updated, or additional pollutants may be added in the future. Using a gross weight basis, transportation is responsible for 60% of total USA emissions. Most of this pollution is carbon monoxide. However, when these data were subjected to pindex evaluation, the transportation category dropped to 19% of the total behind the industrial and electric power generation categories. Because of their lower tolerance levels, particulates, sulfur oxides, and nitrogen oxides all surpassed carbon monoxide in pollution severity. The pindex method was applied to air quality data for ten individual cities. Chicago and Los Angeles ranked highest, while San Diego ranked lowest. The results of the pindex evaluation were roughly comparable with those published in an earlier U. S. Public Health Service study which used a different ranking method. Jet engine emission data were also subjected to pindex evaluation. Use of 'clean' burner cans eliminated 99% of the hydrocarbon emissions, but the pindex evaluation showed that much of the hydrocarbon reduction was neutralized by increased nitrogen oxide emissions.

APTIC-23883

### SOME ASPECTS OF SIZE MEASUREMENT IN AEROSOLS.

Atmos. Environ., 4 (3):301-309, May 1970. 9 refs.
T. A. Rich.
Identifiers: *Aerosols, *Particle size, *Diffusion, Mathematical analyses.

For many years the size of an aerosol has been deduced from its behavior under conditions of high diffusion losses. It became common practice to take the value of the radius of the unknown aerosol as that obtained with a diffusion loss of 50%, and in much of the early work it is this radius that is reported. An approximation as a function of radius of the diffusion loss equations is given which makes it easier to hand calculate transmissions for a variety of distributions. The results are applied to data on the charged fraction of an aerosol as a function of size.

APTIC-23890

### INVESTIGATION OF THE 'SALTZMAN FACTOR'.

(Untersuchungen zum 'Saltzman-Faktor'). Text in German. Staub, Reinhaltung Luft, 30 (7):294-296, July 1970. 12 refs.
Hans-Joachim Crecelius, and Walter Forwerg.
Identifiers: *Saltzman method, *Nitrogen dioxide (no2), Germany, Nitric oxide (no), Ions.

According to Saltzman, 0.72 moles of nitrite ions produce the same coloration of the reaction solution proposed by him as one mole of gaseous nitric oxide. This 'Saltzman factor' has been attacked several times. Investigations into the behavior of nitrogen dioxide introduced into diluted soda lye indicate that $NO_2$ is converted in the ratio of 1:1 only if the concentration is in the range of parts per thousand or higher. If $NO_2$ diluted to less than 1 ppm is introduced into diluted soda lye, it forms almost quantitative nitrite ions. The conversion factor of gaseous $NO_2$:$NO_2$ ions is thus confirmed. (Author abstract modified)

APTIC-23895

### ANALYTICAL METHODS FOR THE STUDY OF AIR POLLUTION.

Pure Appl. Chem., 21 (4):439-447, 1970. 21 refs.
Philip W. West.
Identifiers: *Analytical methods, Measurement methods, Continuous monitoring, Microscopy, Mass spectrometry, Hydrofluoric acid, Nitrogen oxides, Sulfur dioxide, Ozone.

A general discussion of the requirements of air pollution analytical techniques is presented, followed by descriptions of specific techniques for sulfur dioxide, nitrogen oxides, ozone, and hydrogen fluoride. Other inorganic gases and the category of organic gases are mentioned as being within the realm of air pollutants. The subject of particulate measurement is touched upon with some degree of emphasis on both organic and inorganic carcinogens. The applications of microscopy, mass spectroscopy, and several other instrumental techniques are briefly mentioned. The principal thesis is that a need exists for increasingly sensitive and specific methods of analysis for continuous monitoring, field test, and critical or definitive studies.

APTIC-23907

### MOTOR VEHICLE POLLUTION CONTROL NEWS.

J. Air Pollution Control Assoc., 20 (10):682-683, Oct. 1970.
John N. Pattison.
Identifiers: *Engine exhausts, *Sampling methods, Federal governments, Regulations, Emission standards, Automotive emissions, Vehicles, Measurement methods.

A conceptual description is provided of the new Federal test procedures adopted by the Department of Health, Education, and Welfare for sampling and analyzing motor vehicle exhaust emissions. The principal difference in the new procedures is that they place the tests on a mass-per-unit-volume-air emitted by a car. The California 7-mode test, the current basis for federal regulation, provided results on a ppm basis which penalized cars with a smaller air throughput. This was only partially compensated for by the weight allowance factor in current regulations, since a wide variety of engines could be used in cars within a single weight class. The substance of the newly adopted test philosophy is to collect the total exhaust gases during the test cycle, mix them, and obtain an average value of each pollutant from the combined operating modes. A filler item at the end of the column makes note of the fact that the Small Business Administration has recently eliminated the smoke plume from the factory chimney pictured in their official seal.

APTIC-23908

### SUPERSONIC MOLECULAR BEAM SAMPLING SYSTEMS FOR MASS SPECTROMETRIC STUDIES OF HIGH PRESSURE FLOW SYSTEMS.

Avco-Everett Research Lab., Everett, Mass., AF Contract F04701-68-C-0036, ARPA Order 1092, SAMSO-TR-69-113, Avco RR-326, 65p., April 1969. 44 refs. CFSTI, DDC: AD 687098
John Chang.
Identifiers: *Supersonic molecular beam, *Gas sampling, *Mass spectrometry, Sampling methods, Design criteria, Chemical reactions, Condensation, Fluid flow, Gases, Pressure, Temperature.

Experiments are reported on beam intensity and mass separation effects for a mass spectrometer sampling system designed for chemically reacting gases at 1000 K and one atmosphere. The coupling between the reacting chamber and the mass spectrometer was achieved by a supersonic molecular beam of the type suggested by Kantrowitz and Grey. The initial expansion was accomplished by a free jet from a continuum sonic orifice. The system was designed to minimize the change in chemical composition of the sampled gas by orifice boundary layer contamination, sample-skimmer interaction, chemical reactions and condensation during the expansion, mass separation and background gas infiltration. Beams from known sources were generated and sampled. The observed beam intensity and composition were compared to those calculated from theory. A review of the present state of the art of molecular beam technology as it applies to sampling, together with background material to illustrate the main requirements imposed on molecular beam systems in this application is included.

APTIC-23943

### A QUANTITATIVE STUDY OF THE LIMED FILTER PAPER TECHNIQUE FOR FLUORINE AIR POLLUTION STUDIES.

Intern. J. Air Water Pollution (London), 4 (3/4):247-255, 1961. 12 refs. (Presented at the American Chemical Society, 136th Meeting, Atlantic City, N. J., Sept. 1959.)
Donald F. Adams.
Identifiers: *Limestone, *Colorimetry, *Filters, *Hydrofluoric acid, Absorption, Exposure chambers, Fluorides.

Some statistical relationships are presented between lime paper fluoride levels and experimental hydrogen fluoride atmospheric concentrations at constant air flow rates. The lime-impregnated papers were prepared by dipping Whatman No. 2, 11.0 cm filter paper in 10 g/liter of Fisher 'low in fluorine' lime. They were then dried to 50-60 C, hung in a phytotron plant growth chamber, and exposed to hydrogen fluoride in a chamber with a light source. At the end of each lime paper exposure period, the papers were removed from the fumigation chamber, dried for 24 hours at 70 C, weighed, ashed, distilled, and analyzed using a thorium nitrate titration. Correlation between the fluoride accumulated by the lime papers and the exposure indexes is quite high as indicated by the linear and curvilinear r values of 0.946 and 0.069. The data show an average fluoride collection rate of 7.6 micrograms F (-)/d sq m/day/micrograms F (-)/cu m. Results are discussed in relation to previously published literature relating fluoride accumulation in lime paper exposed to industrial air pollution under field and greenhouse conditions. Additional data are presented which show that the fluoride concentration in a greenhouse atmosphere is significantly decreased over relatively short distances through processes of surface adsorption and foliar pickup. (Author abstract modified)

APTIC-23947

### CRC EVALUATION OF AVIATION EMISSION - - MEASUREMENT TECHNIQUES.

Preprint, Society of Automotive Engineers, Inc., New York, 19p., 1970. (Presented at the National Air Transportation Meeting, New York, N. Y., April 20-23, 1970, Paper 700338.)
T. O. Wagner.
Identifiers: *Engine exhausts, *Aircraft, *Analytical methods, *Sampling methods, Particulates, Gas turbines, Hydrocarbons, Oxides, Carbon dioxide, Carbon monoxide, Nitrogen oxides.

Methods for sampling, handling, and measuring emissions of particulates, hydrocarbons, carbon monoxide, carbon dioxide, nitrogen oxides, and oxygenated compounds in the exhaust of aircraft turbine engines were evaluated in a cooperative experimental program conducted by industry and government. Nondispersive infrared (NDIR) instruments and a Fisher chromatographic partitioner were both well suited for measuring CO and $CO_2$. Some additional development is needed in NDIR instruments and the phenol disulphonic acid (PDS) method for measuring nitrogen oxides and in the 3-methyl-2-benzothiazolinone hydrazine hydrochloride (MBTH) method for measuring oxygenated compounds. Available flame ionization detector (FID) analyzers performed satisfactorily in measuring hydrocarbons in the range 200-300 ppm carbon, such as prevailed at idle rpm, but they were not reliable for the range of 10 ppm or less that prevailed at high rpm. In handling samplings for hydrocarbon measurements, short,

hot Teflon lines with high flow rates appear to be optimum; but, with proper care, satisfactory results can be obtained with long, cold lines. Carbonaceous particulates measured by Los Angeles County Air Pollution Control District (APCD) samplers, Leco crucibles, and Scientific Advances Cascade Impactors agreed fairly well. The significance of water-soluble and solvent-soluble materials collected in the APCD samplers need further study. Single-point sampling of the engine tail-pipe plane must be validated by a traverse before it can be taken to yield representative emissions. (Author abstract modified)
APTIC-23952

### OZONE CHEMILUMINESCENT STUDY. (FINAL REPORT PART I.).

Research Triangle Inst., Research Triangle Park,
N. C., Engineering and Environmental Sciences
Div., Contract CPA-22-29-7, 98p., Dec. 1969. 6
refs. CFSTI: PB 194116
J. B. Tommerdahl.
Identifiers: *Chemiluminescent meters, *Ozone, Radiation measuring systems, Visible radiation.

A comprehensive engineering description is given of the design, construction details, calibration techniques, and operational characteristics of experimental ozone meters. The meters utilize a chemiluminescent disc (Rhodamine-B) discs as the basic sensor. The principle on which they operate is as follows: when ozone reacts with certain organic compounds, a minute amount of light is emitted. The amount of light is directly proportional to the ozone concentration, and the wavelength of the emitted light is a function of the organic dye or compound used in the formation of the chemiluminescent disc. Gas samples are passed over a disc coated with the dye. The emitted light resulting from the reaction with ozone is detected by means of a sensitive photodetector. With a freshly-prepared Rhodamine-B discs, the meters detect ozone concentrations on the order of 1 ppb in ambient air. A decrease in instrument sensitivity occurs as the Rhodamine-B disc is consumed. The dynamic range of the instruments is at least 1 ppb to 10 ppm. Repeatability of measurements should be quite good when monitoring ambient ozone levels with a 'stable' disc.
APTIC-23960

### RESOLUTION LIMITS OF FRAUNHOFER HOLOGRAPHY. (FINAL REPORT).

ARO Inc., Tullahoma, Tenn. and Tennessee
Univ., Tullahoma, Space Inst., AFSC Contract
F40600-69-C-0001, Proj. 4344, Task 32, Program
Elements 64719F, 62201F, AEDC-TR-70-23, 62p.,
May 1970. 19 refs. CFSTI, DDC: AD 706403
Ronald A. Belz.
Identifiers: *Holography, Particulates, Particle size, Photographic methods, Diffraction.

The resolution of an in-line hologram recorded with plane waves in the Fraunhofer region of a circular, opaque particle is evaluated. The intensity distribution about the image is found from the diffraction integral for the reconstructed real image. Criteria for determining the edge of the image, in addition to the plane of the focus, are specified from the data; the measurement accuracies are found. The inaccuracies are a result of the inability of the film to record all of the light diffraction by the particle. The reasons for this, film grain noise and its cutoff frequency dynamic range, are explained and their relative effects compared for the various particle sizes and recording distances. Inline Fraunhofer holography is a convenient means of recording and measuring particle size, position, and velocity in a dynamic volume, but aerosol studies have brought out the need to know the limiting accuracy for measuring the size and position of the reconstructed image. (Author abstract modified)
APTIC-23961

### DETERMINATION OF ORGANIC CONTAMINANTS IN AIR AND WATER BY HIGH-RESOLUTION MASS SPECTROMETRY.

Preprint, American Chemical Society,
Washington, D. C., 10p., 1970. 14 refs. (Presented
at the American Chemical Society, New Jersey-
New York Regional Meeting, March 1970.)
A. G. Sharkey Jr., J. L. Shultz, T. Kessler, and R.
A. Friedel.
Identifiers: *Mass spectrometry, *Polynuclear compounds, Carcinogens, Particulates, Sewage treatment, Water pollution.

A limited investigation is reported using high-resolution mass spectrometry to examine organic pollutants in airbone particulate matter and in waste water from a sewage treatment plant. Precise mass data were obtained for about 750 peaks in the mass 76-266 range. Data presented include results on ten typical polynuclear species of air pollutants and partial mass spectra of a series of other substances, to illustrate the ability of the method to detect organic compounds having the same nominal molecular weight but different precise mass resulting from the presence of heteroatoms. A major advantage of this type of instrumentation is that the elemental compositions of a wide variety of components can be determined on essentially total samples. Information concerning alkyl derivatives such as carbon number distribution data obtainable by mass spectrometry could be of prime importance in studies of carcinogenic pollutants. A limitation is that particular isomers cannot be determined. Combined gas chromatographic-mass spectrometric techniques, particularly use of high-resolution mass spectrometry in this combination, will increase the usefulness of the method for studies of organic pollutants. (Author conclusions modified)
APTIC-23964

### ULTRAVIOLET SPECTROPHOTOMETRIC DETERMINATION OF MIXTURES OF N-HEXYL SALICYLATE AND SALICYLIC ACID IN PROPYLENE GLYCOL.

Anal. Chem. Acta, vol. 38:507-516, 1967. 12 refs.
M. D. Bitron, and Y. Suzin.
Identifiers: *Salicylic acid, *Glycols, *Salicylates, *Spectrophotometry, Asia, Aerosols, Sampling methods, Organic acids, Alcohols, Esters, Ultraviolet radiation, Water, Vapors.

Propylene glycol (PG) is proposed as solvent for the collection and analysis of samples of vapors and aerosols in industrial hygiene and air pollution work, and n-hexyl salicylate is suggested as 'model' compound for these systems. A UV-spectrophotometric method is described for simultaneous determination of n-hexyl salicylate and salicylic acid in pure and aqueous PG solutions, at concentrations of 0-35 micrograms/ml. The method is based on water content determinations and on absorbance measurements at 305 nm and, after addition of aqueous potassium hydroxide, at 335 nm. Simplifying approximations are proposed for less accurate work, the errors involved are evaluated, and possible improvements are suggested. An important part of the overall error obtained in comparison experiments may be due to faulty interpolation, since the dependence of the absorptivities upon water content is non-linear. For higher accuracy, it may therefore be worthwhile to determine in more detail absorptivity vs. water concentration instead of relying upon interpolation between a few discrete values. (Author summary modified)
APTIC-23965

### SAMPLING OF BLOW DOWN GAS IN CRANK-CASE SCAVENGED DIESEL ENGINES WITH AN INPACT-ACTUATED SAMPLER.

Preprint, American Society of Mechanical
Engineers, New York, 12p., 1970. 27 refs.
(Presented at the American Society of Mechanical
Engineers Diesel and Gas Engine Power
Conference and Exhibit, Dallas, Tex., April 12-16,
1970, Paper 70-DGP-13.)
A. Kannappan.
Identifiers: *Blowby, *Diesel engines, *Sampling probes, Sweden, Gas sampling, Source sampling, Design criteria.

The performance of a spring-loaded, semi-automatic gas impact-actuated sampler was evaluated for sampling blow down gases in a crank-case scavenged diesel engine. A simple design modification permitted the sampler valve to act as a circuit breaker, thus allowing determination of sampling time by oscilloscope. The duration was compared with the blow down period, which was arrived at through a simple analysis of the charge exchange process on the basis of steady state principles. The samples can be relied upon only at high engine load conditions, a conclusion verified by tracer gas tests. The sampling down-stream pressure is an important criterion governing truthfulness of the samples. In practice, this pressure is chiefly controlled by the sampling rate with which it varies inversely. Too low a sampling rate promotes defective function of the probe, and rates between 5-8 cc/min are considered favorable. To guarantee unpolluted samples of blow down gas, the sampling pressure should be held above peak scavenge pressure. If this is not possible, valve performance can be checked by recording of sampling duration or tracer gas methods. Care should be taken in designing the spring-mass system to avoid vibrational condition at engine test speeds. With low speed engines, this may be a problem due to the soft springs that are normally used in the sampler.
APTIC-23968

### DETERMINING THE UTILITY OF A NEW OPTICAL TEST PROCEDURE FOR MEASURING SMOKE FROM VARIOUS WOOD PRODUCTS.

Forest Products Lab., Madison, Wis., Dept. of
Agriculture, RP-FPL 137, 20p., June 1970. 7 refs.
NTIS, DDC: AD 708948
J. J. Brenden.
Identifiers: *Smokes, *Photometric methods, *Exposure chambers, Wood, Operating variables, Design criteria, Combustion.

The amount of smoke developed from a range of wood and wood-base products under controlled fire exposure was measured optically within a closed chamber. The purpose of this investigation was to determine the utility of this method of measuring smoke and the appropriateness of the parameters used for potential smoke development. To insure a wide range of smoke development, samples of 12 wood species and 10 wood-base panel products are useful primarily in evaluating this new test method and should not be used for code classification of smoke densities or values. When exposed to a flame in the chamber, representatives of the various wood species produced little smoke. With nonflaming exposure, the species gave off more smoke, and the smoke level was strongly dependent on the level of irradiation. The wood species could be broadly separated according to smoke production, but an exact classification of smoke yield was not possible with the limited number of tests in this study. The least amount of smoke for the panel products was observed from a laminated paperboard. Other panel products gave off smoke in widely ranging quantities depending on the irradiation level and whether the combustion was flaming or nonflaming. In rigid insulation board (plank), a fire-retardant paint coating was very effective in reducing smoke production. The chamber used has three advantages over other methods of smoke measurement. The first advantage is that the smoke-density parameter is dimensionless, which means that this chamber method can be applied to a variety of room situations, burning areas, and ligh-path lengths. The second advantage is that the exposure conditions are carefully controlled and uniform. The third advantage is that flaming and nonflaming combustion measurements can be made separately and independently, unlike flame-spread tests in which the specimen is exposed to varying degrees of radiant energy and a moving flame front. (Author summary)
APTIC-23997

### THE FILTRATION OF PARTICLES OF ATOMIC DIMENSIONS.

For primary bibliographic entry see Field 02.
APTIC-23999

### PYROLYTIC SEPARATION AND DETERMINATION OF FLUORIDE IN RAW MATERIALS.

Anal. Chem., 33 (9):1261-1264, Aug. 1961. 11 refs.
M. J. Nardozzi, and L. L. Lewis.
Identifiers: *Spectrophotometry, *Fluorides, *Pyrolysis, Colorimetry, Experimental methods, Oxides, Oxygen, Temperature.

Because fluoride separations from raw materials by distillation are difficult as well as lengthy, another separation technique was evaluated which consists of passing moist oxygen over the sample in a heated tube, sweeping the fluoride released through the tube, and collecting the fluoride in a suitable medium for determination. A quartz combustion tube is employed and heated to 1000 C. The sample is mixed with tungstic oxide as a reaction accelerator, while oxygen is passed through the system at a rate ot about 1200 ml per min. When the samples contain less than 0.1% fluoride or also contain acidic substances, then the slower spectrophotometric method must be used in place of titration. Thorium chloranilate is a very useful reagent for the spectrophotometric determination of fluoride because acetate, sulfate, sulfite, nitrate, nitrite, chloride, bromide, iodide, and thiosulfate ions do not interfere, and phosphate and molybdate interfere only when present in amounts equal to or in excess of the fluoride concentrations. To overcome the interference of iron and aluminum in samples of slag, the samples should be treated prior to pyrolysis to cause hydrolysis or the fluoride should be determined titrimetrically. However, errors arise when sulfur is present in titrimetric determinations.
APTIC-24008

### AMPEROMETRIC TITRATION OF FLUORIDE WITH THORIUM USING A ROTATING PALLADIUM ELECTRODE.

Anal. Chem., 30 (5):1000-1003, May 1958. 14 refs.
W. E. Harris.
Identifiers: *Fluorides, *Amperometric titration, Canada, Analytical methods, Trace analysis, Experimental methods, Organic acids, Bromides, Chlorine compounds, Aluminum compounds, Potassium compounds, Phosphates, Sulfates.

The amperometric titration method for determining traces of fluoride is performed in a solution containing potassium bromide, potassium sulfate, and aerosol, and buffered with monochloroacetic acid and sodium monochloroacetate. Best results are obtained with about 100 to 200 gamma of fluoride per 100 ml of solution, although as little as 20 gamma in 100 ml can be determined. Moderate amounts of chloride, nitrate, sulfate, perchlorate, borate, calcium, or magnesium cause no interference but large amounts slightly decrease the sensitivity. Aluminum and more than 1 mg/l of phosphate interfere. Reagents, apparatus, and the recommended procedure are indicated. (Author abstract)
APTIC-24018

### INTERACTION OF AMMONIUM FLUORIDE MULLS AND DEPOSITED FILMS WITH SODIUM CHLORIDE PLATES.

Anal. Chem., 34 (11):1505-1506, Oct. 1962. 7 refs.
David S. Crocket, and Robert A. Grossman.
Identifiers: *Ammonium compounds, *Fluorides, *Sodium chloride, *Spectrophotometry, Operating variables, Ammonium chloride, Chlorides.

Anomalous absorption peaks were found when ammonium fluoride was run as a mull, as well as when it was deposited as a film from anhydrous methanol. All spectra were run using a Beckman I-R5 spectrophotometer, while the x-ray powder photograph of the surface scrapings from sodium chloride plates was taken using CuK-alpha radiation. The ammonium fluoride run, both as a mull and as a film deposited from methanol, gives only a spectrum comparable to ammonium chloride. In order to get any indication at all of the presence of ammonium fluoride, it was necessary either to precipitate the ammonium fluoride from anhydrous methanol solution with dry ether, or to dry the ammonium fluoride for extended periods of time at a temperature just below the sublimation temperature, and then to prepare the mulls in a dry box.
APTIC-24022

### PROPERTIES OF VARIOUS FILTERING MEDIA FOR ATMOSPHERIC DUST SAMPLING.

Proc. Am. Soc. Testing Materials, Philadelphia,
Pa., vol. 53:1122-1135, 1953. 10 refs. (Presented at
the American Society for Testing and Materials
Annual Meeting, 56th, June 28-July 3, 1953.)
Walter J. Smith, and Norman F. Surprenant.
Identifiers: *Filters, *Particulate sampling, Dusts, Fumes, Smokes, Particle size, Membrane filters, Glass fabrics, Treated fabrics.

A group of atmospheric dust sampling media, including AEC filter paper, CWS filter paper, Whatman filter paper, and membrane filters, were studied for performance characteristics. The media were selected to represent those in use in a number of laboratories. Test methods used included dioctyl phthalate smoke penetration, atmospheric dust penetration, efficiency by particle size, and plugging rate on atmospheric dust. A wide range of properties was observed. Chemical filter papers, designed primarily for wet use, are popular for those test methods that are based on discoloration of the collecting surface. There appears to be more useful properties associated with membrane filters than with any other single medium. Felt-like papers are designed for efficient air cleaning and serve that purpose well. The all-glass papers are recommended for use when high temperatures or corrosive fumes are present. A discussion of the paper is included.
APTIC-24026

### MEASUREMENTS OF AIR POLLUTION.

World Health Organization, Copenhagen
(Denmark), Regional Office for Europe, Proc.
Conf. Public Health Aspects Air Pollution Europe,
Milan, Italy, 1957, p. 136-172. 50 refs. (Nov. 6-14.)
G. Bergshoeff, and L. J. Brasser.
Identifiers: *Operating variables, *Measurement methods, Europe, Colorimetry, Spectrophotometry, Spot tests, Automatic methods, Continuous monitoring, Turbidimetry, Sampling methods, Impingers, Filters, Sulfates, Ions, Water.

The following methods and instruments for measuring air pollutants are briefly described and evaluated: (1) instruments for comparative measurements, including rain gauges, the Liege globe for dust collection, automatic filter, and gas absorption on an impregnated roll; (2) devices for measurement of absolute concentrations, including impingers and semi-automatic and continuous sampling systems. The advantages and disadvantages of short-duration measurements are discussed. A report is also given or research on different methods for determining small concentrations of the sulfate ion in aqueous solution. The literature is reviewed and standard methods are noted. Turbidimetric and nephelometric determinations are applicable in the case of very small quantities, although relatively inaccurate. An improved turbidimetric method was developed involving the use of gum arabic, which gave unexpectedly intense and stable turbidities. Both visual (Nessler tubes) and instrumental (spectrophotometric) procedures gave good results; the advantages and drawbacks of each are outlined. The smallest sulfate concentration measurable was 0.5 mg of SO4 per liter, although relative errors are large.
APTIC-24032

### SPECTROPHOTOMETRIC DETERMINATION OF FLUORIDE BY ZIRCONIUM-ERIOCHROME CYANINE R.

Anal. Chem., 36 (8):1684-1685, July 1964. 11 refs.
P. L. Sarma.
Identifiers: *Cyanides, *Fluorides, *Zirconium compounds, *Spectrophotometry, Operating variables, Chlorides.

The fluoride concentration range which is most suitable for spectrophotometric determination using original and modified Megregian zirconium-Eriochrome Cyanine R reagents was determined. A standard solution containing 100 ppm of fluoride was prepared by dissolving 0.2221 gram of 99.5% pure sodium fluoride in water and diluting it to 1 liter, while other standard solutions were prepared by diluting aliquots of this solution ot proper volumes. Per cent transmittance readings of reagent A (Eriochrome Cyanine R) and reagent B (Zirconium Chloride) were obtained at 528 millimicrons, maintaining the temperature within 25 plus or minus 1 C. Considering both the minimum relative concentration error and the linear absorbance-concentration range, Megregian's original reagent appears suitable for use in the determination of about 1.0 to 1.4 ppm of fluoride. However, from the same considerations, a modified reagent containing 1 volume of reagent A and 2 volumes of reagent B will be suitable for determining about 2.0 to 3.0 ppm.
APTIC-24050

### OZONE GAS ANALYSIS BY POLYMER CHAIN SCISSION.

Angew. Makromol. Chem., 7 (83):101-109, 1969. 9 refs.
H. H. G. Jellinek, and A. Burkhardt.
Identifiers: *Ozone, *Chemical methods *Synthetic rubber, Measurement methods, Styrenes.

A novel method is described for the determination of small amounts of ozone in air by chain scissioning of polymer films due to the high reactivity of ozone. The proposed method has a sensitivity limit for high molecular weight of polystyrene of 2 ppm of ozone in air. However, a butyl rubber has a lower sensitivity limit of 0.02 ppm plus or minus 20% at 35 C and 24 hours reaction time. The latter can be decreased considerably if higher temperatures are used. Still lower sensitivity limits could be in principle attained with butyl rubber of longer chain length and higher isoprene content. Nitrogen dioxide and sulfur dioxide at low concentrations will not interfere with the process. (Author abstract modified)
APTIC-24053

### THE EFFECT OF THE COLUMN TUBING COMPOSITION OF THE RECOVERY OF CHLORINATED HYDROCARBONS BY GAS CHROMATOGRAPHY.

J. Chromatog., 10 (2):231-233, Feb. 1963. 3 refs.
Herman Beckman, and Arthur Bevenue.
Identifiers: *Chlorinated hydrocarbons, *Construction materials, *Gas chromatography, Aluminum, Copper, Steel, Quartz, Operating variables, Pesticides.

Recovery data for microgram quantities of chlorinated hydrocarbons (p-p'-DDT, technical DDT, DDD, DDE, heptachlor, endrin, and dicloran) were obtained for gas chromatographic columns with copper, stainless steel, aluminum, or quartz tubing. All the metal columns were 6-ft long and 1/4-in. outer diameter. The quartz column was 6-ft long, 6-mm outer diameter, and 4-mm inner diameter. Copper tubing showed the poorest per cent recovery in a number of determinations and quartz tubing the best. Reproducibility of the results on a given day were plus or minus 3%, with the exception of heptachlor. In addition to column tubing composition, the analyses of the chlorinated hydrocarbons were influenced by the purity of the compounds, accuracy of sampling, and temperature of the chromatographic system.
APTIC-24055

### MEASURING ODOUR POLLUTION.

New Scientist, 48 (723):116-119, Oct. 15, 1970.
Jan Barynin.
Identifiers: *Odorimetry, Thresholds, Great britain, Odors, Photometric methods, Mercaptans.

The prospects are considered of introducing scientific standards for assessing odor pollution as an aid towards legislation on odor abatement. In much previous work on odors, human beings were subjected to different concentrations of odorous materials under artificial conditions in laboratories. However, the present experiments were conducted out-of-doors with a photomultiplier tube, and observer responses were compared with the detector curves. A typical experiment which is illustrated suggests that the nose and the detector have similar sensitivities and that the olfactory threshold for methylmercaptan is a few micrograms/cu m. What the records did not indicate was the variety of other sensations experienced.
APTIC-24071

### DUST STANDARDS INSTRUMENTATION AND MEASUREMENT REQUIREMENTS.

For primary bibliographic entry see Field 11.
APTIC-24072

### COMPARISON OF ICE NUCLEUS CONCENTRATIONS MEASURED WITH AN ACOUSTICAL COUNTER AND MILLIPORE FILTERS.

J. Appl. Meteorol., 9 (5):828-829, Oct. 1970. 3 refs.
Peter V. Hobbs.
Identifiers: *Particle counters, *Membrane filters, *Ice, Nucleation.

Concentrations of ice nuclei in air were measured simultaneously by the acoustical ice nucleus counter and Millipore filter. The comparison measurements were made in January 1969 at a weather station on the Olympic Peninsula approximately 12 miles from the Pacific Ocean. The acoustical counter was run at -20 C, and outside air was drawn through the chamber at 0.01 cu m reciprocal min. One Millipore filter was exposed every 24 hr during which time 0.3 cu m of air was drawn through the filter. Results of the measurements, together with the prevailing weather conditions, are summarized in a graph. With one exception, the average concentratio of ice nuclei measured over each 24-hr period by the Millipore technique was greater than that measured by the acoustical counter. In general, there is little or no correlation in the day-to-day variations in ice nuclei concentrations as measured by the two techniques. While a constant difference in count between two techniques might be tolerable, it is unacceptable to have a variable difference in count so that the fluctuations reported by the two techniques are dissimilar.
APTIC-24078

### AUTOMATED MEASUREMENT OF THE INTERNAL SURFACE AREA OF THE HUMAN LUNG.

IEEE (Inst. Elec. Electron. Engrs.) Trans. Bio-Med. Eng., BME-17 (3):254-262, July 1970. 7 refs.
Martin D. Levine, Michael L. Reisch, and William M. Thurlbeck.
Identifiers: *Lungs, *Measurement methods, *Computer programs, Diagnosis, Alveoli, Emphysema, Canada, United states.

The problem of determining severity and extent of emphysema is shown to relate to the reduction of the internal or alveolar surface area of the lung. A computerized method of measuring this internal surface is described. The method is based on digitization of black and white films of microscopic images of lung tissue and on an image-processing technique that uniquely labels each connected component of a picture. In the transformed image, the alveoli can be identified by a single lable, and thus mean chord length measurements become trivial. A flying-spot scanner system is used to transform the visual information into electrical signals. An off-line video data-acquisition system was designed for this purpose. Image-processing algorithms are discussed in relation to the problem of effectively smoothing the image to minimize noise. Two mapping operations are used which can discrimate alveolar septa from 'background noise.' These mapping images, therefore, lend themselves to a simplified analysis which the computer can perform. A complete set of data from two normal lungs was processed with the algorithms. The results, when compared to corresponding data produced by trained operators, demonstrated the feasibility of image-processing techniques for objectively grading emphysema.
APTIC-24092

### CONTINUOUS DETERMINATION OF H2S IN FLUE GASES CONTAINING SO2.

Svensk Papperstid. (Stockholm), 73 (17):525-527, Sept. 15, 1970. 3 refs.
Jan G. T. Bergstrom, and Ants Teder.
Identifiers: *Stack gases, *Electroconductivity analyzers, *Hydrogen sulfide, Sweden, Dusts, Continuous monitoring, Silver compounds, Nitrates, Sulfur oxides, Water.

A correct determination of hydrogen sulfide cannot be carried out in the presence of sulfur dioxide with instruments in which the blackening of lead acetate is used. The interfering effect of SO2 is eliminated by using silver nitrate instead. An instrument for the continuous determination of H2S in the presence of SO2, based on the blackening of silver nitrate-impregnated paper, has been developed from a commercially available instrument, originally using lead acetate-impregnated paper. A prototype of this instrument has been tested in mill trials and found to be satisfactory. The Monocolor instrument determines H2S by measuring the current difference between two photocells viewing respectively the reagent paper before and after exposure to the gas under analysis. The range of the instrument can be varied from 0--150 mg H2S/cu m to 0--5 mg H2S/cu m by varying the time of exposure from 1 min to 30 min by adjustment of a timer. In order to obtain correct and reproducible results it is essential to remove dust and condensed water from the gas before analyzing. It is recommended to take out the flue gas sample after the electrostatic precipitator and on the pressure side of the flue gas fan.
APTIC-24097

### CHARACTERIZATION AND CONTROL OF GASEOUS AND PARTICULATE EXHAUST EMISSIONS FROM VEHICLES.

Preprint, Air Pollution Control Assoc., Los Angeles, Calif., West Coast Section, 33p., 1970. 24 refs. (Presented at the Air Pollution Control Assoc., West Coast Section, Technical Meeting, 5th, San Francisco, Calif., Oct. 8-9, 1970.)
K. Habibi, E. S. Jacobs, W. G. Kunz Jr., and D. L. Pastell.
Identifiers: *Engine exhausts, *Engine operation modification, *Engine design modification, Operating criteria, Emission standards, Particulates, Gasolines, Operating variables, Automobiles, Particle size, Afterburners, Aromatic hydrocarbons, Tetraethyl lead, Carbon dioxide, Nitrogen oxides.

Work done on the characterization of the particulate matter contained in vehicle exhaust and on the development of systems to control, simultaneously, both gaseous and particulate emissions is described. A total exhaust control system comprising exhaust manifold thermal reactors, exhaust gas recirculation, and particulate traps has been developed. Using present-day leaded gasolines, this system controls hydrocarbons, carbon monoxide, nitrogen oxides and exhaust particulate emissions to levels below those proposed for 1975. The system also markedly reduces levels of polynuclear aromatic hydrocarbons and 'tar' in the exhaust. The exhaust particulate trap system reduces lead particulate emissions to 0.03 gram per mile. Such a system, replacing the conventional exhaust system of the vehicle, provides a tenfold reduction of lead particulate emissions. Equipment and techniques have been developed for the characterization and measurement of particulate emissions from vehicles. These techniques are applicable to a study of the solids emitted in the exhaust, such as lead salts, rust and soot. They also are applicable to the determination of the carbonaceous materials, including emitted tars and polynuclear aromatics. Average cars emit about 0.3 to 0.5 gram per mile of filterable particulate material and 0.8 to 1.0 grams per mile of 'tar'. Lead salts account for 0.25 to 0.35 gram per mile of filterable particulate. Over half of the lead salts emitted is associated with particles of greater than 9 microns equivalent diameter, which settle very rapidly in the atmosphere. Under consumer, motorist-type driving conditions, the use of unleaded gasoline will not lower exhaust particulate emission levels to the proposed level of 0.10 grams per mile for 1975. Levels of 0.15 to 0.25 gram per mile of filterable exhaust particulates have been observed with a conventional car operating on unleaded gasoline. Furthermore, there is some suggestion that the use of unleaded gasoline could adversely affect atmospheric visibility and increase 'soiling.' (Author summary modified)
APTIC-24107

### COMPARISON OF SOME LUNG-DEPOSITION MODELS USED IN THE SAMPLING OF RESPIRABLE DUST.

California Univ., Livermore, Lawrence Radiation Lab., 7p., Aug. 7, 1970. 7 refs. NTIS: UCRL-50914
Jerry J. Cohen, and Donald N. Montan.
Identifiers: *Lungs, *Deposition, *Dusts, *Mathematical modeling, Toxicity, Aerosols, Particle size, Samplers.

In determining exposure levels to toxic aerosols, the desirability of separating these materials into respirable and non-respirable fractions is well established. The separation of dust samples into respirable and nonrespirable fractions usually follows guidelines based on the recommendations either of the British Medical Research Council (BMRC) or of a meeting held at Los Alamos Scientific Laboratory (LASL). The two guidelines result in differences in the curves, because the BMRC approximates the horizontal elutriator and the LASL approximates the clyclone separator. Relative to the basic errors inherent in the air sampling process such as statistical variation, directional dependence, and analytical sensitivity, it appears that errors in respirable dust preseparations are probably insignificant. Any instrument reasonably designed for the purpose would probably suffice. Even something as simple as an impactor with an effective cut-off diameter of about 3.0 to 5.0 microns should give satisfactory results in pracitcal field sampling. The time and effort spent in developing dust separators with characteristics that very precisely match those of the upper respiratory tract might better be spent elsewhere. (Author abstract modified)
APTIC-24113

### STEAM DISTILLATION OF FLUORINE FROM PERCHLORIC ACID SOLUTIONS OF ALUMINIFEROUS ORES.

Anal. Chem., 31 (10):1657-1662, Oct. 1959. 25 refs.
E. J. Fox, and W. A. Jackson.
Identifiers: *Distillation, *Perchloric acid, *Fluorine compounds, Experimental methods, Aluminum compounds, Calcium compounds, Iron compounds, Sodium compounds, Phosphates, Steam, Temperature, Volatility.

An all-glass multiple-unit fluorine distilling apparatus equipped with automatic temperature controls was developed in a study of factors affecting the volatilization of fluorine during the acidulation of phosphate rock. An improved apparatus and the analytical procedure are discussed. Sodium and calcium fluorides, or even the slightly more complex calcium fluosilicate dihydrate, show little difference in the rate of fluorine distillation from perchloric acid at 125 C. A rate of about 15% per

minute for each of these salts is indicated by the slope of the main branches of the curves. While phosphate rock may not be regarded as a simple compound, the fluorine in the rock, for the most part, behaves as calcium fluosilicate while a relatively small proporation of it behaves like fluorine in Pembroke clay. The initial rate for the first and second fluoride ions of aluminum fluoride trihydrate is about one third the rate for fluorine in sodium fluoride, or approximately 5% per minute. Results obtained with this equipment indicate that the interference of aluminum in the steam distillation of fluorine from perchloric acid solutions of aluminum-bearing rocks is caused by the formation of acid-soluble complex ions of aluminum, fluorine, and possibly other elements that greatly reduce the partial pressure of fluorine compounds in the gas phase above the distilling acid solution. A procedure for simultaneous double distillation to speed up the operation is described. (Author abstract modified)
APTIC-24114

### ATMOSPHERIC POLLUTION.

Ind. Eng. Chem., 45 (8):105A-108A, Aug. 1953. 6 refs.
Louis C. McCabe.
Identifiers: *Measurement methods, *Instrumentation, Oxidants, Smog, Colorimetry, Continuous monitoring, Filters, Bag filters, Filter fabrics, Hydrofluoric acid, Iodine, Ozone, Fluorescence.

Various filter media were evaluated with respect to certain air sampling requirements by the dioctyl pthalate smoke penetration meter. Several properties and applications are presented tabularly for chemical filter papers, membrane filters, feltlike and mineral fiber papers, and all-glass papers. At the same meeting of the American Society for Testing Materials (July 1953), another paper described some instrumentation and analytical techniques which had proved useful in the study of air pollution with particular reference to the Windsor-Detroit area. A continuous recording analyzer for trace quantities of hydrogen fluoride in the atmosphere is based on a test in which a metal oxinate fluoresces under ultraviolet light, and the fluorescence is quenched by exposure to hydrogen fluoride. In order to study the relationship between smog occurrence and oxidant concentration, a continuous recorder was constructed which produces a record in terms of ozone equivalents. The oxidant recorder consists essentially of a countercurrent absorption tower of glass beads as the air-liquid contacting device. Air containing ozone, nitrogen oxides, or other oxidants liberates iodine from a buffered, neutral potassium iodide solution. The light transmission of the resulting yellow solution is measured by a double-cell colorimeter at 3600 A.
APTIC-24118

### LEAD-IN-AIR-ANALYZER.

Am. Ind. Hyg. Assoc. J., 19 (4):330-337, Aug. 1958. 5 refs. (Presented at the American Industrial Hygiene Association, Atlantic City, April 24, 1958.)
T. Dowling, R. B. Davis, R. C. Charsha, and A. L. Linch.
Identifiers: *Sampling methods, *Lead compounds, Aspirators, Impingers, Scrubbers, Calibration methods, Design criteria.

Successful adaptation of a special high efficiency micro-aspirator powered by a Freon-12 propellent provides a simple, low-cost and effortless means of collecting and scrubbing the required large volume samples for lead determinations. Modifications consisted of reducing the air sample from 4 to 2 cu ft and replacement of the special scrubber by a midget impinger. The air sampling apparatus consists of a power assembly, aspirator, charcoal trap, and scrubber. This apparatus is contained in a small metal case which is designed to be carried or to be worn on a safety harness while the air sample is being obtained. A thermometer, calibration chart and timer are also included. In addition, auxiliary or spare equipment is available consisting of a vacuum gauge, two spare scrubbers, three spare one-pound cans of Freon-12 Power Pak Propellent and a spare charcoal trap. The analysis apparatus consists of two comparator tubes, a Hellige Comparator, a Deeminac Water Purifier, and 8 boxes of reagents. Each box of reagents contains sealed vials loaded with the exact amount of lead-free chemicals required for one determination. Operation of the lead-in-air-analyzer is outlined, as well as its maintenance and precautions concerning the reagents. The analyzers may be used to aid in determining whether a tank that has been judged clean is lead-free or whether an area involving a spill of tetraethyl lead has been properly decontaminated.
APTIC-24123

### FLUOROMETRIC DETERMINATION OF SMALL AMOUNTS OF FLUORIDE.

Anal. Chem., 25 (6):960-964, June 1953. 15 refs.
W. Allan Powell, and J. H. Saylor.
Identifiers: *Quenching, *Fluorine compounds, *Fluorescence, Experimental methods, Chlorides, Aluminum compounds, Sodium compounds, Ph.

Methods are described for the fluorometric determination of traces of fluoride with a precision equal to or better than previous methods and which are less subject to anion interference. Experimental equipment comprised a Lumetron fluorometer and a Beckman pH meter. A Corning 5860 primary filter was used for the isolation of the desired excitation band and a Corning 3389 secondary filter for the fluorescence band. Most of the methods previously described for the fluorometric detection or determination of aluminum were studied: those using morin, quercetin, 8-quinolinol, Eriochrome Blue Black B, which is an isomer of Pontachrome Blue Black R, and Eriochrome Red B. Superchrome Garnet Y was also studied. The methods finally developed depend upon the fact that the intensity of fluorescence of the compounds formed on reaction of aluminum chloride with the dihydroxyazo dyes, Eriochrome Red B and Superchrome Garnet Y, is decreased on addition of fluoride. Plots of intensity of fluorescence versus pH show a maximum at pH 4.8, while the intensity decreases slightly with increase in the buffer concentration. Effects of concentration and purity of dyes were also determined. The intensity of fluorescence increases linearly with increase in concentration of ethyl alcohol and decrease in temperature. The methods were tested by analyzing solutions of pure sodium fluoride both before and after a Willard-Winter distillation.
APTIC-24124

### COLORIMETRIC AND ULTRAVIOLET SPECTROSCOPIC INVESTIGATION OF NITROGEN DIOXIDE AND ALKYL NITRITES.

Preprint, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, 22p., 1957 (*). 15 refs.
Aubrey P. Altshuller, Donald Stephens, and Carol Myers Schwab.
Identifiers: *Saltzman method, *Ultraviolet spectrometry, *Nitrogen dioxide (no2), Infrared spectrometry, Peroxyacyl nitrates, Nitrites, Organic nitrogen compounds.

An acute need exists in air pollution studies for the development of specific analytical methods permitting differentiation between nitrogen dioxide and organic nitrites and nitrates. The two most common methods used are the Saltzman procedure and infrared spectroscopy. Since there are various problems with each of these methods, an evaluation is performed of the usefulness of ultraviolet spectroscopy in analyzing for NO2 and organic nitrites. The results indicate that the colorimetric methods used for nitrogen dioxide in air pollution are not specific for NO2 but are specific fall all compounds containing the O - N - O grouping. These include NO2, alkyl nitrites, probably acetyl peroxy nitrites and possibly other complex reaction products formed by the reaction of N2O4 with olefins at higher concentrations in combustion devices. Ultraviolet spectroscopy in solution does permit some degree of identification of NO2 in the presence of alkyl nitrites but this method necessitates concentration to the 1000 ppm range. The data available on the infrared spectra of NO2, alkyl nitrites, alkyl nitrates, and nitroso compounds indicate interferences by some or all of these classes of compounds at the 6.2, 7.9 and 13.2 micron bands of NO2. Consequently, only when NO2 is the only compound present possessing the N equals O group would analysis be feasible by use of infrared spectroscopy. The identification of N2O4 complexes with organic compounds of oxygen and nitrogen containing electron-donor pairs at room temperature may be accomplished by use of ultraviolet spectroscopy. (Author summary modified)
APTIC-24130

### PERFORMANCE CHARACTERISTICS OF THE FPP-15 FILTER MATERIAL USED IN THE USSR FOR ENVIRONMENTAL RADIOACTIVITY MONITORING.

Naval Research Lab., Washington, D. C., Physical Chemistry Branch, and Naval Research Lab., Washington, D. C., Protective Chemistry Branch, Grant A02-13 and C05-16, Proj. RR-004-02-42-5151, RR-001-01-43-4700. and AEC AT (49-7)-2435, Rept. NRL-6165, 9p., Sept. 30, 1964. NTIS, DDC: AD 608209
R. L. Patterson Jr., L. B. Lockhart Jr., and W. L. Anderson.
Identifiers: *Radiation measuring systems, *Membrane filters, *Filter fabrics, Aerosols, Particle size, Ground level, Radioactive radiation, Electric charge.

A survey of the physical properties and operational characteristics is made of the FPP-15 filter paper widely used in the Soviet Union for monitoring airborne radioactivity. This filter material is composed of a thin mat of small-diameter, unoriented fibers of polyvinyl chloride deposited on a cotton scrim backing. Due to its composition, the filter readily picks up an electrostatic charge which causes some difficulty in handling but which contributes to an increased initial retentivity toward submicron aerosol particles. After dissipation of the electrostatic charge through normal operation of the filter device, the retention characteristics are similar to those of other filter media having comparable flow characteristics. The filter is an effective material for use in systems designed for monitoring airborne fission products at ground level. Functionally, the filter combines low resistance to air flow with good retentivity toward fission-product aerosols. (Author abstract modified)
APTIC-24131

### ON THE EMPLOYMENT OF JET IMPACTORS FOR COLLECTING PARTICLES OF UNKNOWN PROPERTIES.

Atmos. Environ., 4 (3):289-300, May 1970. 13 refs.
G. Haenel.
Identifiers: *Jet impactors, *Aerosols, *Gravity settling, Germany, Particulates, Samplers, Mathematical analyses, Transport, Flow rates.

Equations are derived which demonstrate that the collection efficiencies of atmospheric particles in a jet impactor have a higher correlation with their settling velocity than with their equivalent radius. Therefore, the employment of jet impactors for the analysis of frequency distributions of the settling velocity is considerably less erroneous than for the analysis of frequency distributions of the equivalent radius. Frequency distributions of the settling velocity are of interest for studies on the transport of aerosol particles in the atmosphere. Other equations presented give the relations between the operational parameters of the impactors and the physical properties of the air. These relations must be satisfied for measurements at different places and times to be compatible. The general statements made in this paper hold for all particle analyzers which are based on the inertial

principle or on measurement of mobility. (Author conclusions modified)
APTIC-24139

### ON THE AIR POLLUTION IN THE INDUSTRIAL AREA OF THE NORTHEASTERN COAST OF TOKYO BAY (4TH REPORT) - PUBLIC NUISANCE CONTROLS IN CHIBA PREFECTURE.

Keiyo rinkaikogyochitai no taikiosen (dai 4 po) -
Chibaken ga totteiru kogaitaisaku ni tsuite). Text
in Japanese. Kishocho Kenkyu Jiho (Journal of
Meteorological Research (Tokyo)), 22 (4):176-181,
April, 1970. 3 refs.
Ichiro Mitani, and Tatsuya Seki.
Identifiers: *Air quality measurement programs, *Control programs, *Chiba prefecture, Survey methods, Alerts, Regional governments, Research institutes, Japan, industrial areas, Dust fall, Automatic methods, Lead peroxide candle, Monitoring.

Growth inhibition of peaches at the period of blooming, acute fluorine injury of ears of rice and taros, and serious damage of Japanese red pines indicated the need for an air-pollution control program in the coastal industrial areas of Chiba prefecture. As a consequence, the Chiba Laboratory was established in 1966 and an intensive program of surveys and measurements was undertaken. An air pollution monitoring network now covers the whole coastal area stretching from the northern and down to Tokyo Bay. Of the 145 monitoring sites, 20 are for dust fall movements, 100 use the PbO2 method, and 25 are automated. An important aspect of the control program is the issuance of two types of warnings: caution and alert. The warnings are immediately relayed with the aid of radio and television broadcasts and newspapers, in addition to the local and municipal administrative bodies concerned. There also exists a Public Nuisance Prefectural Research Institution for general pollution control. Other technical countermeasures, related equipment and official programs to minimize industrial pollution are presented.
APTIC-24157

### PERFORMANCE OF AN IMPROVED AIR SAMPLER FOR COLLECTING AIRBORNE RADIOIODINE.

J. Nucl. Sci. Technol., 7 (9):450-457, Sept. 1970. 21 refs.
Seiji Fukuda, and Mitsuo Naritomi.
Identifiers: *Samplers, *Filters, *Iodine compounds, *Isotopes, Charcoal, Asbestos, Japan, Continuous monitoring, Humidity.

An airborne radioiodine sampler composed of cellulose asbestos filter paper, charcoal-impregnated filter paper, and two charcoal cartridges was developed to ensure higher and more reproducible collection efficiencies under high humidity conditions encountered in routine air monitoring. Laboratory tests were made to determine the efficiency of the sampler for collecting (131) released from an iodine processing cell. Its collection efficiency was far less dependent on relative humidity; the sampler was notably superior to samplers consisting of a single filter medium. Even under very high humidity conditions, the average collection efficiency for 24-hr sampling periods was more than 75%. During a 30-min sampling period, the collection efficiency exceeded 80% for airborne iodine sampled at the exit of an air cleaning system containing charcoal filters. For unfiltered iodine at 40-60% relative humidity, the efficiency reached almost 100%. The performance of the sampler is not significantly affected by face velocity. (Author abstract modified)
APTIC-24159

## 4. AIR QUALITY MEASUREMENTS

### THE CONTAMINATION OF PRECIPITATION IN THE UPPSALA REGION DURING JULY - OCTOBER 1962.

For primary bibliographic entry see Field 03.
APTIC-18298

### THE ACIDITY AND THE CONCENTRATION OF SULPHATE IN PRECIPITATION OVER EUROPE.

Statens naturvardsverk, Stockholm, (The Swedish
National Nature Conservancy Office), 10p., 1968.
Translated from Swedish.
G. Persson.
Identifiers: *Ions, *Sulfates, *Precipitation, *Statistical analyses, *Acidity, *Europe, Sweden, Chemical methods, Isotopes, Ph.

The European network of atmospheric chemistry stations have around 100 stations. Precipitation is sampled on a monthly basis and analyzed for ions of Na, K, Ca, Mg, NO3, NH4, Cl, SO4, and HCO3, pH, electric conductivity and to some extent the isotopes tritium, deuterium, and O18. Air samples also on a monthly basis, are analysed for ions of Na, K, Ca, Mg, and for NH3, Cl, and SO2. (All data except for the isotopes have been transferred to punch cards and are available from the International Meteorological Institute Tulegatan 41, Stockholm.) The large number of data from measurements over a period of about 15 years have been evaluated and show that there has been an increase in the acidity of the precipitation during the last years in most parts of Europe. Data from Sweden, Norway, Finland, Denmark, Iceland, Austria, Germany, The Netherlands, Belgium, France, Great Britain, and Ireland are presented. During the period 1955-66 pH has decreased between 0.05 - 0.09 units per year in Sweden. Only one station shows lower values. The pH-values are compared with the precipitation of sulphur.
APTIC-18301

### DETERMINATION OF NITROUS GASES IN AIR.

For primary bibliographic entry see Field 03.
APTIC-18304

### STUDIES ON THE ANALYSIS OF CONTAMINATING SUBSTANCES IN THE ATMOSPHERE.

For primary bibliographic entry see Field 03.
APTIC-22290

### THE ERRORS IN THE ANALYTICAL CALCULATION OF THE DISPERSION OF ATMOSPHERIC TRACE SUBSTANCES (A CRITICAL COMPARISON BETWEEN MEASURED AND CALCULATED SO2 CONCENTRATIONS).

Staub (English translation from German of:
Staub, Reinhaltung Luft), 30 (1): 15-22, Jan. 1970.
7 refs. CFSTI: TT 70-50047/1
Gerhard Manier.
Identifiers: *Dispersion, *Tracers, *Sulfur dioxide, Air quality criteria, Germany, Chemical processing, Mathematical analyses, Research methodologies, Sulfuric acid.

The question of reliability of the calculated values for concentration frequently occurs in investigations into the propagation of trace substances in the atmosphere. A comparison was, therefore, made between about 2000 measurements, of sulfur dioxide concentration in the vicinity of a sulfuric acid plant, and the corresponding calculated values. The agreement between the values is unsatisfactory. Causes of the disparities are invalid assumptions or inaccurate data. (Author abstract modified)
APTIC-22306

### THE INCREASE IN THE SO2-CONCENTRATION DURING LONG-TERM WEATHER SITUATIONS WITH POOR DIFFUSION.

For primary bibliographic entry see Field 05.
APTIC-22310

### THE SECULAR INCREASE OF THE WORLD-WIDE FINE PARTICLE POLLUTION.

J. Atmospheric Sci., 21 (2):168-181, March 1964.
16 refs.
Ross Gunn.
Identifiers: *Oceans, *Particulates, *Air quality measurements, Electroconductivity analyzers, Air pollution forecasting.

The increase in the world-wide fine particle pollution of the atmosphere between 1914 and 1962 is inferred from measurements of the electrical conductivity of the atmosphere over the surface of the North Atlantic. Systematic instrumental errors are reported in some of the early measurements of conductivity made on the research ship Carnegie which have long been considered as 'standard'. Measurements for the seventh cruise of the Carnegie should be muluplied by 1.39 to correct for errors introduced by eddy diffusion. Notable improvements in the design of the electrical conductivity apparatus and an electric field meter permit the continuous collection and recording of data at sea even under adverse conditions such as heavy fog and light rain. More than 12 days of continuous new measurements in all kinds of weather during May-June 1962 are summarized. A comparison of the new measurements with the corrected values of the early Carnegie observations suggests that the electrical conductivity of the atmosphere over the North Atlantic has decreased by about 5% between 1929 and 1962. This implies a measurable and parallel increase in the average fine particle pollution of the atmosphere that is doubtless world-wide and represents an increasing hazard to the health of all terrestrial life, but the data fail to confirm earlier forecasts that this increase in pollution will occur at a very great and alarming rate. (Author abstract modified)
APTIC-22440

### RESULTS FROM A STUDY OF ATMOSPHERIC OZONE IN THE USSR DURING THE IQSY (1964-1965).

(Nekotoryye rezul'taty isseldovaniy
atmosfernogo ozona v SSSR v period MGSS
(1964-1965 gg). Text in Russian. Tr. Gl. Geofiz.
Observ. (Leningrad), no. 213:80-92, 1968. 13 refs.
G. P. Gushchin, K. I. Lisovskaya, A. M.
Shalamyanskiy, and O. N. Chemyakina.
Identifiers: *Air quality measurements, *Ussr, *Ozone, Annual, International.

Atmospheric ozone measurements made at 33 points throughout the USSR during the International Year of the Quiet Sun are tabulated, and maps showing ozone isolines are presented. Ozone content ranged from 0.22-0.50 cm. Minima in ozone content occurred around August to October of both years. Comparisons reveal an ozone content significantly lower than that recorded during the IGY (1958-1959), but data are insufficient to make a correlation with solar activity. Comparisions with data taken in Norway, Japan, Denmark, and England are made, and deviations from the arithmetic mean (-12.5 to 8.0%) are tabulated.
APTIC-22476

### CONTROL OF INDUSTRIAL POLLUTION IN THE SARNIA AREA. (INDUSTRIAL PROGRESS REPORT).

40p., Nov. 1960.
Personal Author Not Recorded.
Identifiers: *Sarnia area, *Chemical processing, *Water pollution, *Air quality measurements, Plans and programs, Lachrymation, Canada, Commercial areas, Industrial areas, Residential areas, Rivers, Aerosols, Suspended particulates, Dust fall, Measurement methods, Control methods, Phenols, Sulfur oxides, Hydrogen sulfide.

Basic facts of air and water pollution are presented as they exist in the Sarnia area, and the voluntary action of indutry in this area to solve and eliminate pollution problems is outlined. Despite the considerable industrial growth, the total mean dustfall in Sarnia has increased but slightly from approximately 57 to 62 tons per square mile per month. Heavier dustfall conditions were found to exist west of Vidal Street towards the river within the main industrial area. The average concentration of suspended matter and aerosols found in the residential area was approximately 100 micrograms per cu m as compared with 156 micrograms per cu m in the commercial section. Phenol concentrations in the St. Clair River have been measured since 1953, while the maximum concentration of hydrogen sulfide gas recorded was 0.1 ppb of air, which is just on the threshold of odor perception. Equipment used in the investigations included dust collectors, a high volume sampler, low volume smoke sampler, a Thomas autometer, and an anemometer. After analyzing for organisms in over 100 samples taken from the river bottom, pollution was concluded to take place close to the Canadian shore from a point just north of Sarnia's industrial area to a point just north of Talfourd Creek. Dr. Morris Katz's report seeking a solution to the lachrymator problem is summarized, and the companies are listed which are possible sources of contaminants, as well as their methods to combat air and water pollution.
APTIC-22512

### RADIONUCLIDES AND LEAD IN SURFACE AIR.

In: Health and Safety Laboratory Fallout Program Quarterly Summer Report. Appendix. Atomic Energy Commission New York, Health and Safety Lab., p. 1-6, 78-81, July 1, 1970. CFSTI: HASL-227
H. L. Volchok, and M. T. Kleinman.
Identifiers: *Area surveys, *Air quality measurements, *Lead compounds, *Radioactive radiation, Survey methods, Membrane filters, Isotopes.

Since January 1963, the Atomic Energy Commission Health and Safety Laboratory has been conducting the Surface Air Sampling Program, the primary objective of which is to study the spatial and temporal distribution of nuclear weapons debris and lead in the surface air. From late 1965 through March 1969, samplers were placed on four Atlantic Ocean weather ships to extend the surface air study over the marine environment. Approximately 1400 cu m of ambient air per day are drawn through a 20 cm diameter Microsorban filter for the land stations; at the ocean stations, about 2200 cu m of air per day are filtered with 20 by 25 cm Microsorban filters. The gamma activity of half of the monthly composites are obtained with an 8 by 4-in. sodium iodide crystal. The other halves of the monthly composites are sent to a contractor laboratory for radiochemical analyses. Tables are presented for stable lead concentrations in surface air for 1966, 1967, 1968, and 1969.
APTIC-22553

### THE ESTIMATION OF HYDROGEN SULFIDE IN ATMOSPHERE AIR AT WARSAW.

(Oznaczanie siarkowodoru w powietrzu atmosferycznym w warszawie). Text in Polish. Acta Geophys. Polon. (Warsaw), 15 (1):71-79, 1967. 24 refs.
Tadeusz Burakowski, and Maria Szymonska-Karlikowska.
Identifiers: *Warsaw, *Air quality measurements, *Hydrogen sulfide, Europe, Sulfur dioxide, Sulfates.

According to the literature, sulfur compounds in nature have received a great deal of attention in recent years. The circulation of sulfur in nature is very complicated. There are three main sulfur compounds in the atmosphere: sulfur dioxide, hydrogen sulfide, and sulfate ions in the form of aerosols. Hydrogen sulfide in the atmosphere is of the same importance as SO2. H2S is determined using the methylene blue method. Preliminary analyses made in Warsaw in 1965 indicate that the H2S concentration in the air is nearly stable. (Author abstract modified)
APTIC-22571

### ANALYSES OF SMOKE OBSERVATIONS AT OTTAWA, CANADA.

Preprint, Air Pollution Control Association, New York City, 8p., 1961. 8 refs. (Presented at the Air Pollution Control Association, Annual Meeting, 54th, New York, June 11, 1961.)
R. E. Munn, and C. R. Ross.
Identifiers: *Smokes, *Air quality measurements, Diurnal, Canada, Spot tests, Samplers, Filters, Winds, Wind rose, Sulfur dioxide, Density.

During the period July 1956 to May 1957, two-hourly measurements of smoke density were recorded at two sites in the city of Ottawa; a standard filter-paper-tape sampler was used and spots were evaluated by light transmission measurement. Emphasis was placed on class frequency distributions rather than on mean values to avoid the problem of whether or not response of the A.I.S.I. sampler is linear with increasing smokiness. A preferred method for displaying the diurnal cycle of pollution is to select the time of day of the highest Coh value from each day and determine the frequency distribution of these times. This is preferred because it normalizes and stratifies the data, permitting comparison of sampling stations having widely different mean smokiness levels. Three ways were suggested for examining the relation of smokiness to wind: compare wind roses associated with very high Coh values with wind roses associated with very low Coh values; select the highest Coh value for each day and determine the frequency distribution of the associated wind; and determine the wind frequencies associated with high peak/mean ratios of smokiness. Method 1 is the most useful display for the air pollution control officer, but methods 2 and 3 may be indirectly helpful in interpreting results. A comparison of Coh values with sulfur dioxide readings for the same sites and periods of records can be particularly informative. On the average, the two-hourly daily peak Coh value is about twice as large as the mean value for the day. (Author conclusions modified)
APTIC-22581

### ATMOSPHERIC AIR POLLUTION IN LITHUANIAN CITIES.

For primary bibliographic entry see Field 01.
APTIC-22591

### CARCINOGENIC AIR POLLUTANTS. DETERMINATION OF POLYNUCLEAR AROMATIC HYDROCARBONS IN THE ATMOSPHERE OF ROME.

(Contaminanti cancerogeni nell'aria atmosferica. Determinazione di idrocarburi policiclici aromatici nell'atmosfera di Roma). Text in Italian. Nuovi Ann. Igiene Microbiol. (Rome), vol. 17:264-296, July-Aug. 1966. 126 refs.
P. Valori, and A. Grella.
Identifiers: *Rome, *Air quality measurements, *Polynuclear compounds, Carcinogens, Italy, Urban areas, Chromatography, Spectrophotometry, Particulate sampling, Anthracenes, Chrysenes, Fluoranthenes, Naphthacenes, Perylenes, Pyrenes, Benzo (3-4)pyrene.

A review of work published on carcinogens found in a polluted atmosphere is followed by two series of experiments conducted in Rome, the first between late February and late May of 1964; the second, in late spring of 1964. In both cases, dust samples were collected on paper filters, separated by chromatography, and subjected to spectrophotometric analysis for the determination of the hydrocarbons. The concentrations of 3,4-benzopyrene and 1,12-benzoperylene were considerably lower than those obtained in a study of the previous year. Other polynuclear hydrocarbons that were detected were pyrene, fluoranthene, 1,2-benzanthracene, naphthacene, chrysene, anthanthrene, and coronene.
APTIC-22607

### INTERSTATE EFFECTS SURVEILLANCE NETWORK. 1969 DATA.

NAPCA Pub. APTD 70-3, 203p., May 1970.
CFSTI: PB 192446
Personal Author Not Recorded.
Identifiers: *Interstate effects surveillance network, *Air quality measurements, Air quality measurement programs, Corrosion, Discoloration, Metals, Steel, Lead, Zinc, Rubber, Cottons, Nylon, Non-urban areas, Commerical areas, Industrial areas, Residential areas, Particulates, Dusts, Dust fall, Soiling index, Lead peroxide candle, Silver compounds, Nitrogen oxides, Sulfur dioxide, Ozone.

The annual summary of raw data for 1969 from the Interstate Effects Surveillance Network is presented. A total of 274 stations report the measurements of metal corrosion, silver tarnishing, dustfall, nylon deterioration, rubber cracking, wind blown particulates, sulfur dioxide level, and the effects of nitrogen oxides, ozone, soiling, and sulfur dioxide on dyed fabrics. Some conversion factors are given, and a frequency distribution of the 1968 data is provided.
APTIC-22703

### AIR POLLUTION SMOKE AND SO2.

(Pollution atmospherique Fumee et SO2). Text in French. Bull. Mens. Inst. Royal Meteorol. Belgique, 1969:25p., Aug. 1969. CFSTI: N70-26439
J. Bouquiaux, and J. Grandjean.
Identifiers: *Air quality mesasurements, *Sulfur dioxide, *Smokes, Monthly, Belgium, France, Non-urban areas, Industrial areas, Air quality measurements, Dust fall, Sulfur oxides.

A series of tables presents the daily pollution indexes for the month of August 1969 in the Belgian provinces of Brabant, Limbourg, Liege, Luxembourg, Namur, Hainaut, West Flanders, East Flanders, and Antwerp. Graphical representations are given of the pollution indexes for the industrial complexes of Brussels, Liege, Charleroi, Gent, and Antwerp. Two indexes are given: smoke and sulfur dioxide.
APTIC-22775

### NEW INVESTIGATIONS OF THE PRESENCE OF POLYNUCLEAR AROMATIC HYDROCARBONS IN THE ATMOSPHERIC DUST OF THE HISTORICAL CENTER OF THE CITY OF SIENA.

(Nuove indagini sulla presenza di idrocarburi policiclici aromatici nel pulviscolo atmosferico del centro storico della citta di Siena). Text in Italian. Nuovia Ann. Igiene Microbiol. (Rome), 18 (4):285-292, July-Aug. 1967. 14 refs.
G. Bosco, G. Barsini, and A. Grella.
Identifiers: *Siena, *Air quality measurements, *Polynuclear compounds, Italy, Urban areas, Dusts, Vehicles, Aromatic fractions, Aromatic hydrocarbons, Anthracenes, Chrysenes, Fluoranthenes, Perylenes, Pyrenes, Benzo (3-4)pyrene.

The results are given of a qualitative and quantitative study conducted in Siena, Italy, September 1965 to June 1966 wherein a total of 16 polynuclear hydrocarbons were detected, including anthracene, pyrene, fluoranthene, 1,2-benzanthracene, chrysene, perylene, 3,4-benzopyrene, 1,12-benzoperylene, anthranthene, and coronene. In general, the results indicate that the closing of the historical center of the city to motor traffic has a beneficial effect on air quality in the area, as it relates to the presence of the above-mentioned compounds. In particular, there was a notable decrease in the content of 3,4-benzopyrene.
APTIC-22777

### THE SURVEY OF AIR POLLUTION IN AN INDUSTRIAL CITY: SHEFFIELD.

Biometeorol. Proc. 3rd Int. Biometeorol. Congr.,
1963, 2 (2): 641-647, 1967. 1 ref. (Sept. 1-7.)
Alice Garnett.
Identifiers: *Area surveys, *Sheffield, *Topographic interactions, Diurnal, Hourly, Great britain, Urban areas, Industrial areas, Residential areas, Valleys, Smokes, Air quality measurements, Mapping, Diffusion, Anticyclones, Winds, Stability (atmospheric), Sulfur dioxide.

Some preliminary cartographic results of an air pollution survey in Sheffield, under anticyclonic conditions, are considered in relation to peculiarities of site and urban functional patterns, as well as with reference to both hourly and daily records of changes with respect to smoke and sulfur dioxide. The bold relief which ranges from 100 to over 1000 ft above sea level is associated with a starlike pattern of deeply sunk converging valleys which, under anticyclonic conditions, favor the drainage of stagnant stable air, sometimes in depth, preventing the free diffusion of pollutant matter. On the other hand, at times of active air circulation in this fragmented relief, there will still be much variation in wind speed locally. Imposed on this physical pattern is an urban functional pattern associated with residential areas extending over the spurs and low plateaus, with industries mainly consolidated in the low lying and highly congested Don valley. The steady increase in daily peak pollutant values in relation to calms and inversion of temperature is very evident, but the amplitude of the diurnal fluctations in pollution even during the periods of greatest severity, and the marked diurnal rhythm that is apparent is surprising.
APTIC-22785

### NATURAL ION LEVELS IN THE CITY OF PHILADELPHIA.

American Inst. of Medical Climatology,
Philadelphia, Pa., Proc. Intern. Conf. Ionization
Air, Philadelphia, Pa., 1961, 1 (11):16p. 10 refs.
(Oct. 16-17.)
F. K. Davis Jr., and F. P. Speicher.
Identifiers: *Philadelphia, *Air quality measurements, *Ions, Diurnal, Hourly, Monthly, Urban areas, Particle counters, Winds, Rain, Thunderstorms, Density, Electric charge.

Continuous ion density and polarity measurements for outdoor air in the City of Philadelphia were made for a one year period extending from May 1958 to May 1959. Two co-axial type ion counters designed and built by the Philco Corporation to collect and record all ions having a mobility of 0.06 (cm/sec)/ (volt/cm) and greater every 107 seconds were used throughout the study. A very clear diurnal variation was revealed with a very sharp rise beginning around sunrise time, a maximum around noon, then a steady decline to a single minimum in the early morning hours. The average hourly mean ion count was about 440 ions/cu cm for each polarity. Measurable rain appeared to always be accompanied by higher negative ion levels. The diurnal variation curve for Uppsala is just about 180 deg out of phase with the curves for Philadelphia, and the Philadelphia data for a clear, calm night show generally the same shape as the average Philadelphia curve, but the ion density is much higher. July shows the lowest concentration, and the months of October and November show the highest counts. Ion levels were highest with winds between northeast and east and lowest with winds between south and southwest. Positive ion levels were higher than the negative ion levels prior to the onset of a severe thunderstorm, and both levels were below the average values. The positive and negative counts both rose sharply at the onset of precipitation with the negative ions reaching a somewhat higher peak; peak values were about 2000 ions/cu cm for each. Ion levels then fell off as the rainfall intensity decreased, but the positive ion levels dropped off more rapidly.
APTIC-22801

### LITERATURE REVIEW OF METROPOLITAN AIR POLLUTANT CONCENTRATIONS—PREPARATION, SAMPLING AND ASSAY OF SYNTHETIC ATMOSPHERES. (FINAL REPORT).

For primary bibliographic entry see Field 03.
APTIC-22812

### EFFECT OF SO2 POLLUTION IN THE VICINITY OF A POWER PLANT.

For primary bibliographic entry see Field 01.
APTIC-23356

### ASH AND SULFUR FROM THE VIEW OF HEALTH.

For primary bibliographic entry see Field 07.
APTIC-23360

### AIR POLLUTION: SMOKE AND SO2.

(Pollution atmospherique: fumee et SO2). Text in
French. Bull. Mens. Inst. Royal Meteorol.
Belgique, 1969: 24p., July 1969. CFSTI: N70-23385
J. Bouquiaux, and J. Grandjean.
Identifiers: *Sulfur dioxide, *Belgium, *Smokes, *Air quality measurements, Diurnal, Monthly, France, Non-urban areas, Industrial areas, Dusts, Soot fall.

Tables give daily pollution indexes (dust and sulfur dioxide) for all the provinces of Belgium and for the industrial complexes of Brussels, Liege, Charleroi, Gent, and Antwerp. All readings of more than 1.3 cubic meters per day and less than 2.7 cubic meters per day are given.
APTIC-23383

### AIR POLLUTION: SMOKE AND SO2.

(Pollution atmospherique: fumee et SO2). Text in
French. Bull. Mens. Inst. Royal Meteorol.
Belgique, 1969: 24p., June 1969. CFSTI: N70-23384
J. Bouquiaux, and J. Grandjean.
Identifiers: *Sulfur dioxide, *Belgium, *Smokes, *Air quality measurements, Diurnal, Monthly, France, Non-urban areas, Industrial areas, Dusts, Soot fall.

Tables give daily pollution indexes (dust and sulfur dioxide) for all the provinces of Belgium and for the industrial complexes of Brussels, Liege, Charleroi, Gent, and Antwerp. All readings of more than 1.3 cubic meters per day and less than 2.7 cubic meters per day are given.
APTIC-23384

### REPORT ON THE AIR POLLUTION RESEARCH OF THE INSTITUTE FOR WATER, SOIL AND AIR-HYGIENE IN THE FEDERAL HEALTH OFFICE OF THE TOWN DISTRICT OF DUISBURG DURING THE YEARS 1954/1956.

For primary bibliographic entry see Field 01.
APTIC-23391

### AIR POLLUTION AND RESIDENTIAL AREAS—RELATIONSHIP BETWEEN AIR POLLUTION AND TOWN PLANNING.

World Health Organization, Copenhagen
(Denmark), Regional Office for Europe, Proc.
Conf. Public Health Aspects Air Pollution Europe,
Milan, Italy, 1957, p. 218-235. 6 refs. (Nov. 6-14.)
B. Paccagnella, and M. Dechigi.
Identifiers: *Air quality measurements, *Sampling methods, *Padua, Planning and zoning, Italy, Urban areas, Residential areas, Lead peroxide candle, Fluorine compounds, Nitrogen dioxide (no2), Sulfur dioxide.

In the early stages of research on the degree of pollution and its distribution in Padua and Venice, a method of measurement based on instantaneous sample collections was adopted. Samples were taken in such a way that deposit meters and peroxide cylinders were always placed downwind. Thus, it was possible to gather data indicating the maximum concentration of polluting substances in the wind stream, irrespective of difficulties caused by variations in or turbulence of atmospheric currents. A total of 803 analyses for sulfur dioxide, nitrogen dioxide, and elemental fluorine have been performed to date for Padua. The results are presented in tabular form and the distribution of the pollutants shown on a map. The implication of the results for town planning is noted.
APTIC-23392

### CHEMICAL COMPOSITION AND PARTICLES SIZE MEASUREMENT OF AIR-BORNE DUST IN THE ATMOSPHERE OF MILAN.

World Health Organization, Copenhagen
(Denmark), Regional Office for Europe, Proc.
Conf. Public Health Aspects Air Pollution Europe,
Milan, Italy, 1957, p. 299-302. (Nov. 6-14.)
Enrico C. Vigliani.
Identifiers: *Milan, *Seasonal, *Chemical composition, *Dustfall, Italy, Urban areas, Dusts, Air quality measurements, Particle size.

Samples of airborne dust collected in Milan from November 1956 to March 1957 and from May to October 1957 were analyzed for weight, losses due to calcination, chemical composition, and particle sizes. The amount of airborne dust by weight was three times higher in winter months than in summer months, indicating that the number of particles suspended in the atmosphere is about 12 times higher in winter than in summer. The percent loss after calcination was 63 in winter as opposed to 38 in summer; the losses represented mainly carbonaceous matter and combustion smoke. The number of particles smaller than 1 micron, especially those smaller than 0.5 micron, was much higher in winter than in summer.
APTIC-23393

### AIR POLLUTION IN WASHINGTON COUNTY MARYLAND.

Maryland State Department of Health, Baltimore,
Div. of Air Quality Control and Washington
County Dept. of Health, 63p., Jan. 1970. 20 refs.
H. L. Alkire, and John Bramblett.
Identifiers: *Washington county, *Sources, Area surveys, County governments, Annual, Monthly, Maryland, Automotive emissions, Combustion products, Odors, Settling particles, Dusts, Suspended particulates, Smokes, Pesticides, Coal, Fuel oils, Industrial emission sources, Steam plants, Mineral processing, Mining, Crop spraying, Domestic heating, Fertilizing, Open burning, Dumps, Dust fall, Soiling index, Stagnation, Sulfur dioxide.

The study was conducted to provide a preliminary survey of air pollution conditions. It is part of a series of county surveys which are being prepared for Maryland. The report is based on measurement of atmospheric pollutants for several years in Hagerstown and on data in the files of the State and county health departments. The measurements of suspended particulate matter indicate that the annual arithmetic average value in some 30 micrograms/cu m higher than the serious level standard of 75 micrograms/cu m and 40 above the adverse level of 65. Some 24 hour readings exceed 160 micrograms/cu m. Measurements of dustfall indicate that the serious level standard of 14 tons/sq mi/mo and the adverse level of 10, is exceeded. Readings in Hagerstown have averaged 18.3 tons/sq mi/mo over a nine-year period. In regard to sulfur dioxide concentrations in the ambient air, a serious level standard of 0.03 ppm and an adverse level of 0.015 ppm (annual arithmetic average) have been proposed. Actual readings were slightly above the serious concentration at 0.031 ppm. The pollution problems are mainly associated with a variety of manufacturing processes, the combustion of coal and oil, and odors from plants using organic chemicals. The increased fuel use for space heating in the winter is closely allied with higher levels of sulfur dioxide and the soiling index. Dust from quarrying opera-

tions at four rural locations creates nuisances in the immediate vicinity of these facilities. Smudge pots which are used to lessen the chances of frost damage to fruit blossoms near Hancock and in the northeastern portion of the county create extremely dirty conditions. The use of insecticides by the orchard industry also creates objectionable odors in those areas. There are two burning dumps, one near Hagerstown rated the fifth worst dump in the State. In the Williamsport area a power plant is responsible for locally heavy emission concentrations and a brick yard and tannery are responsible for other undersirable emissions. With the exception of Hagerstown, Williamsport, and Hancock, Washington County has satisfactorily clean air. There are infrequent cases of stagnation and pollution drift that may temporarily raise pollutant levels in other parts of the county.
APTIC-23411

### TWO ATMOSPHERIC CONSTITUENTS: OZONE AND SMALL IONS.

For primary bibliographic entry see Field 05.
APTIC-23412

### THE SO2-LOAD OF THE GREATER COLOGNE AREA FROM 1964 TO 1968.

Staub (English translation from German of: Staub, Reinhaltung Luft), 30 (1):9-14, Jan. 1970. 17 refs.
CFSTI: TT 70-50047/1
Otto Guthof, and Maria Deimel.
Identifiers: *Cologne, *Air quality measurements, *Sulfur dioxide, Air quality criteria, Germany, Stack gases, Point sources, Winds.

Results of sulfur dioxide measurements carried out at six measuring stations in Cologne from 1964 to 1968 are reported. A steady decrease in concentration, as compared with the maximum values for the year 1962/63, was found at all stations up to 1967; a slight increase occurred again in 1968. This decrease in concentration was caused, in the first place, by meteorological conditions, but also, to a certain extent, by technical improvements in the industry. The simultaneous measurement of wind direction made it possbile to easily detect the specific sources of emission affecting the measuring values obtained at the individual stations. However, SO2 practically never occurs alone, but nearly always together with dust and other gaseous pollutants. In view of the possibility of the combined effect of several pollutants, accurate determination of limit values is impossible, and supplementary guidelines would be desirable for uniform assessment in granting licenses for new industries. (Author abstract modified)
APTIC-23430

### CONCENTRATION OF SULFATE IN AEROSOL AND FOG WATER. COLLECTION OF AEROSOL BY USING A HIGH-VOLUME CASCADE IMPACTER; AND ANALYSIS OF THE SULFATE AND OTHER INORGANIC COMPONENTS.

Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 2 (1):96-98, 1967. Translated from Japanese. 10p.
Toshiichi Okita, Takashi Tezuka, and Hiroshi Umino.
Identifiers: *Urban areas, *Air quality measurements, *Sulfates, Japan, Tokyo, Smog, Visibility, Particle size, Hi-vol samplers, Winds, Clouds, Fog, Humidity, Ammonium compounds, Sulfur dioxide.

A cascade high-volume impacter was adjusted with respect to orifice and flow rate in such a manner as to effect a separation between particles greater and less than 1.5 micron. For sulfate particles in the larger sized group to exist at an SO4/SO2 ratio greater than 0.12, it was determined that the humidity had to be in excess of 55%, wind speed had to be less than 4 m/sec, and the visibility had to be less than 5 km. Ammonia concentrations were higher in Tokyo than in other cities. On October 26, 1966 in conditions of low visibility and heavy daytime smog, sulfate ion concentration, hydrogen ion concentration, and sulfate ion/sulfur dioxide ratio values of 61.8 micrograms/cu m, 7.5 micrograms/cu m, and 69% were obtained. On November 30, 1966, when similar weather conditions prevailed, both the sulfate ion concentration and the hydrogen ion concentration were markedly lower.
APTIC-23450

### GASEOUS CHLORIDE IN THE ATMOSPHERE.

For primary bibliographic entry see Field 03.
APTIC-23451

### CERTAIN ASPECTS OF THE STUDY OF AEROSOLS IN THE LOWER LAYERS OF THE TROPOSPHERE.

For primary bibliographic entry see Field 05.
APTIC-23481

### ATMOSPHERIC POLLUTION. SMOKE AND SO2.

(Pollution atmospherique. Fumee et SO2). Text in French. Bull. Mens. Inst. Royal Meteorol. Belgique, 1969: 24p., April 1969. CFSTI: N70-21339
J. Bouquiaux, and J. Grandjean.
Identifiers: *Belgium, *Air quality measurements, *Sulfur dioxide, Non-urban areas, Urban areas, Dusts, Analytical methods, Membrane filters.

The Belgian surveillance network for air pollution was created on the initiative of the Main Administration for Hygiene of the Ministry of Public Health and Family. Pollution indices included the strong acidity of air expressed in micrograms of sulfur dioxide per cubic meter of air and the smoke or fine dust expressed in micrograms per cubic meter of air. The sampling apparatus (shown schematically and in a photograph) was designed by the Institute for Hygiene and Epidemiology and the Royal Meteorological Institute according to the recommendations of the O.C.D.E. In principle, the apparatus consists of an electric membrane pump sucking about 2 cubic meters of air per day across a filter of Whatman paper No. 1, a bubbling bottle containing 50 ml of oxygenated (0.3% of H2O2) water of pH 4.5, and a gas meter. In fact, the apparatus comprises 8 filter-bubbling bottle circuits which are automatically commuted every morning; thus, the samples are removed but once a week. Reflectometric analysis of the filter paper and acidimetric titration of the bubbling bottle liquid yield the mean concentration of smoke and SO2, respectively, during the 24 hours in which the air samples were collected. The sampling network comprises 230 stations distributed as follows: 100 in the 5 high-density areas of Brussels (25), Antwerp (25), Liege (20), Charleroi (15), and Ghent (15); 100 in less important towns and at selected points in the countryside; and 30 in meteorological stations equipped with anemometers. All data are processed by the Computer center of the Royal Meteorological Institute.
APTIC-23484

### RESEARCH ON AIR FUNGI ISOLATED BY CULTURE SINCE 1940.

(La recherche des champignons de l'air par culture depuis 1940). Text in French. Rev. Can. Biol., 27 (1):61-68, March 1968. 100 refs.
Hans-Wolfgang Ackermann.
Identifiers: *Fungi, *Air quality measurements, Canada, Sampling methods, Lower atmosphere, Winds, Humidity, Precipitation, Temperature (atmospheric).

A review of 95 articles published since 1940 dealing with 240 air fungi is presented, restricted to air strata immediately above ground. All the genera found are listed. The majority of the fungi are of the imperfect type; this result reflects the method of culture as opposed to the method of the lamina for isolating fungi. A schematic geographic distribution of air fungi is attempted. The mycoflora of the air depends on climatic and meteorological factors such as temperature, humidity, precipitation, and winds. In countries with temperate climate, air fungi are present during the period of vegetation and are rare during the cold season; this demonstrates that air mycoflora comes from host plants and not from soil. The method of culture has yielded a great amount of information, but individual data depend strictly on the quality of the work and the competence of the author. Suggestions are given on how to orientate future research.
APTIC-23485

### TOTAL PARTICLE FALL AND THE COMPOSITION OF PARTICULATES IN THE AIR OF SOME FINNISH URBAN AREAS.

Work-Environ.-Health, 6 (1):23-30, 1969. 25 refs.
Arvo Laamanen.
Identifiers: *Urban areas, *Chemical composition, *Dust fall, Europe, Commercial areas, Industrial areas, Residential areas, Ashes, Statistical analyses, Rain, Chlorides, Calcium compounds, Copper compounds, Sulfates, Ph.

Twenty-seven dust fall collection sites in four Finnish cities were classified as representing housing, industrial, traffic, and base level areas. The deposited impurities were collected once a month and analyzed for water solubles, including sulfates, chlorides, and calcium, and water in solubles, including combustible organics and ash. The ash in turn was analyzed for the presence of metals. Rainwater pH was also determined. Statistically significant differences were noted for all impurity parameters except rainwater pH, water soluble impurities, calcium, and copper. Traffic areas were as a rule highest for all impurities where statistically significant differences were found. For CS2 soluble organics and sulfates, the medians for housing areas were the same as for traffic areas. areas were roughly on the same level. The lowest medians were found for base level areas. Larger variation coefficients were clearly observed for site-to-site variation than for monthly variation within sites in the same data matrix for the majority of components. This suggests that grouping sites according to their similar pollution activity is likely to yield internally more homogeneous classes (area types) than when the grouping is made on the basis of closed geographical districts. Figures obtained for homogeneous classes are of more informative value than those for heterogeneous classes.
APTIC-23488

### DATA ON THE STUDY OF BACTERIAL CONTAMINATION OF ATMOSPHERIC AIR OF THE CITY OF ODESSA.

Mikrobiol. Zh. (Kiev), 25 (1):35-41, 1963. 3 refs.
Translated from Russian by L. Marokus, Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., 9p., Feb. 25, 1970. CFSTI, DDC: AD 704021
O. Yu. Grigorashchenko, and L. M. Kharmats.
Identifiers: *Bacteria, *Air quality measurements, Seasonal, User, Urban areas, Microorganisms, Rain, Snow.

From 1956 through 1960, air samples were taken by means of a Krotov apparatus and by the precipitation method at eight points in Odessa. The greatest air contaminations were found over the central sections of the city close to the market place, especially when morning vehicular and pedestrian traffic was the heaviest; in the industrial section of the city; around the harbor; and in the area of the railroad freight station. The fewest microorganisms were found in an area that overlooks the sea and is characterized by abundant vegetation, relatively high humidity, and an absence of dwellings, pedestrians, and vehicular traffic. In winter, the quantity of microbes in 1 cu m of air was considerably lower than in summer. During rainfall or snowfall, the number of colonies was two, three, or even four times less than the standard number in dry weather. Attention is drawn to the fact that 784 strains of representa-

tives of intestinal bacteria were isolated; of these, seven were Flexner's dysentery bacilla; 1, a Newcastle dysentery bacillus; 1, a Boyd-Novogrodsky dysentery bacillus; and 2, Morgan's bacilli. These strains may be of epidemiological importance. (Author summary modified)
APTIC-23553

### ATMOSPHERIC POLLUTION: SMOKE AND SO2.

(Pollution atmospherique: fumee et SO2). Text in French. Bull. Mens. Inst. Royal Meteorol. Belgique, 1969, 23p., May 1969. CFSTI: N70-21870
J. Bouquiaux, and J. Grandjean.
Identifiers: *Belgium, *Air quality measurements, Area surveys, Survey methods, Non-urban areas, Urban areas, Dusts, Sampling methods, Sulfur dioxide.

The Belgian network for the surveillance of air pollution has conducted tests for the measurement of pollution in nine Belgian provinces. Pollution indices used are strong acidity of the air expressed in micrograms of sulfur dioxide per cubic meter of air or fine dust expressed in micrograms per cubic meter of air. The apparatus employed contains eight circuits commuted automatically every morning. Results indicate the lowest monthly average for smoke was in the Liege area, and for SO2 in Charleroi. The highest monthly smoke level was encountered in Antwerp and the highest mean for SO2, in Ghent.
APTIC-23554

### MEASUREMENT OF POLYCYCLIC AROMATIC HYDROCARBONS IN THE AIR OF SYDNEY USING VERY LONG ALUMINA COLUMNS FOR SEPARATION.

For primary bibliographic entry see Field 03.
APTIC-23566

### HYDROCARBON COMPOSITION OF THE ATMOSPHERE OF THE LOS ANGELES BASIN-1967.

Preprint, National Air Pollution Control Administration, Cincinnati, Ohio, Div. of Chemistry and Physics, 33p., 1970. 10 refs.
A. P. Altshuller, W. A. Lonneman, F. D. Sutterfield, and S. L. Kopczynski.
Identifiers: *Hydrocarbons, *Los angeles, *Air quality measurements, Urban areas, Automotive emissions, Oxidants, Aliphatic fractions, Aromatic fractions, Ground level, Aliphatic hydrocarbons, Isobutanes, Methanes, Propanes, Aromatic hydrocarbons, Diurnal.

A study of the relationships among different pollutants was carried out in Los Angeles in the fall of 1967. Part of the study involved gas chromatographic analyses of samples collected in downtown Los Angeles and Azusa; the samples were analyzed for both aliphatic and aromatic hydrocarbons. Diurnal variations of hydrocarbon concentration and frequency distribution were obtained. The lack of relationship of methane, ethane, propane, and isobutane to other hydrocarbons associated with automotive emissions was confirmed. Variations in hydrocarbon composition by location and time of the day were demonstrated. Hydrocarbon concentrations were related to oxidant concentrations at the two sampling locations. Maximum oxidant levels in downtown Los Angeles and Azusa were compared with hydrocarbon levels at these locations. (Author abstract)
APTIC-23621

### SOME MEASUREMENTS OF OXIDANT LEVELS AT REMOTE CALIFORNIA SITES.

Preprint, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, Community Air Pollution Program, 24p., 1958 (*). 6 refs.
Walter K. Harrison Jr., and James P. Lodge Jr.
Identifiers: *California, *Non-urban areas, *Oxidants, Air quality measurements.

Measurements of surface oxidant concentrations at six California sites remote from major municipal air pollution are reported. Pertinent environmental features of these sites such as proximity to the ocean and populated areas, altitude, and wind flow are discussed. Both the manual phenolphthalin and automatic recording potassium iodide methods were used. Procedures varied among the different sampling sites and included once-daily manual determinations, periods of intensive spot-check work for several days in succession, and operation of continuous recorders on two offshore islands for four months. Frequency distributions of daily peak values, times of maxima, and durations are presented and discussed. Unexpectedly high concentrations of oxidant were occasionally found at each remote site, but it was not possible to attribute these to natural sources with complete certainty. (Author abstract modified)
APTIC-23645

### LEAD ISOTOPES IN GASOLINE AND AEROSOLS OF LOS ANGELES BASIN, CALIFORNIA.

For primary bibliographic entry see Field 01.
APTIC-23658

### AN ELECTRON MICROSCOPE STUDY OF PARTICLES IN TOWN AIR.

Intern. J. Air Water Pollution (London), vol. 7:779-786, 1963. 17 refs.
R. E. Waller, A. G. F. Brooks, and J. Cartwright.
Identifiers: *Urban areas, *Suspended particulates, *Air quality measurements, *Electron microscopy, Great britain, London, Coal tars, Ashes, Droplets, Smokes, Domestic heating, Vehicles, Particle size, Sulfuric acid.

An electron microscope was used in the study of the nature of suspended particulate matter collected from the air of London and Sheffield, England. In addition to particles of carbon, tar, and ash, droplets containing dissolved salts and sulfuric acid were identified as being common constituents of urban air. In central London, where most of the heating is by large installations burning oil, coal, or coke smokelessly, the aggregates were usually smaller and occurred less frequently than in Sheffield where much of the heating is still by untreated coal burnt on open fires. The aggregates found in smoke from road traffic were confined to a narrower size range than those found in coal smoke. The aggregates are extremely stable; they do not appear to be affected by time or by the severe chemical treatment necessary to isolate them from human tissue. They can be inhaled and retained in the respiratory system; on recovery from lungs after death, they may still retain their characteristic appearance. They are also unaffected by exposure to high vacuum and electron bombardment in the miscroscope. In contrast, other particulate air pollutants are lost or altered in the preparative treatment or in the conditions prevailing in the electron microscope. The use of the electron microscope provided valuable information on the size distribution and nature of the suspended material. However, the limitations of the method must be recognized. At each stage in the process of collection, preparation, and examination of the specimen, some material may be lost or altered, and the appearance of the particles in the micrograph may not accurately represent the form in which they existed in air. The most valuable application of the electron microscope was in showing the diversity of materials found in urban atmospheres.
APTIC-23662

### THE QUALITY OF THE AIR IN THE SACRAMENTO REGIONAL AREA.

In: The Air Pollution Threat. Sacramento Regional Area Planning Commission, Calif., Technical Paper - 3, 11p., Oct. 1969. CFSTI: PB 191382
W. L. Faith.
Identifiers: *Sacramento, *Air quality measurements, Area surveys, Seasonal, California, Automotive emissions, Oxidants, Particulates, Smog, Solid waste disposal, Vehicles, Automobiles, Stagnation, Carbon monoxide, Nitric oxide (no), Nitrogen dioxide (no2).

The definition of air quality and factors affecting it are discussed briefly in general terms. The meteorology of the Sacramento area creates the potential for a buildup of air pollutants to be most pronounced in late fall and winter; spring, summer, and early fall bring good ventilation. The important pollutants are surveyed. It is concluded that occasionally the California ambient air quality standards for oxidant, nitrogen dioxide, and carbon monoxide are exceeded in the area. There is an incipient photochemical smog problem during periods of stagnant air and bright sunshine, and an incipient CO problem on the occasional days of prolonged atmospheric stagnation. These pollutants are mainly from automotive emissions. Pollution from particulate matter does not seem to be a major problem. Thus the air pollution situation in Sacramento is not a threat to health and there is no indication of unsual economic damage. The only vegetation damage appears to be chiefly the spotting of ornaments. The main thrust of air pollution in the region is in the area of nuisance and esthetics.
APTIC-23664

### AIR POLLUTION IN PITTSBURGH.

Arch. Ind. Hyg. Occupational Med., vol. 3:44-47, 1951. (Presented at the Smoke Prevention Association of America, Annual Meeting, Montreal, Canada, May 23, 1950.)
Sumner B. Ely.
Identifiers: *Pittsburgh, *Dust fall, Steel, Industrial areas, Coal, Primary metallurgical processing, Metal compounds, Zinc compounds, Oxides, Iron oxides, Sulfur compounds, Combustion.

Results are presented for dust fall measurements conducted in Pittsburgh in 1938, 1948, and 1949. The reduction in total dust fall from 1948 to 1949 was nearly as great as for the 10 previous years; the efficiency of combustion taking place in 1948 and 1949 was better than in previous years. Current percentages of toxic metals in the dust were very small and below the point of danger to human beings. However, a high percentage of ferric oxide (18.5%) was found in dust fall containers located east of steel mills. Sulfur percentages were also high, averaging 18.9 in 1948 and 18.5 in 1949 for all sampling locations. Most of the sulfur comes from the general combustion of coal. Zinc unexplainedly increased from 7.5% in 1948 to 13.6% in 1949. Investigations are underway to determine the source of the sudden increase.
APTIC-23737

### ATMOSPHERIC POLLUTION IN THE PONDEROSA PINE BLIGHT AREA.

Ind. Eng. Chem., 44 (6):1356-1365, May-Aug. 1952. 13 refs. (Presented at the American Chemical Society Meeting, 119th, Cleveland, Ohio.)
Donald F. Adams, Delbert J. Mayhew, Richard M. Gnagy, Eugene P. Richey, and Robert K. Koope.
Identifiers: *Air quality measurements, *Fluorine compounds, *Sulfur dioxide, Air quality measurement programs, Trees, Tip burn, Washington (state), Stack gases, Dispersion, Point sources, Winds, Rain, Topographic interactions, Sulfur compounds.

The ponderosa pine trees in the industrialized area north of Spokane, Wash., have exhibited a characteristic reddening of the needles since 1943, known locally as 'ponderosa pine blight.' The blighted area now embraces approximately 50 square miles, and the trees within a 3-square mile area near the center are dead. As a portion of a comprehensive investigation, the concentrations of gaseous fluorine and sulfur compounds in the air during the growing season of 1950 have been determined through operation of twelve air-sampling stations and a mobile air-analysis laboratory. Analysis of rain-water samples obtained during

each rainy period throughout October and November 1950 at 82 locations established the points of origin of the contaminants and the extent of their dispersion. Meteorological and topographical conditions in the ponderosa pine blight area, which control the dispersion of pollutants and explain the damage and pollutant concentration patterns, are discussed. Concentrations of gaseous fluorine compounds in the atmosphere of the area will serve as a guide in controlled fumigation of ponderosa pine. (Author abstract)
APTIC-23760

### METEOROLOGICAL EFFECTS ON CARBON MONOXIDE DISTRIBUTION AT AN URBAN INTERSECTION.

For primary bibliographic entry see Field 05.
APTIC-23793

### PRESENT CONDITION OF AIR POLLUTION IN OSAKA AND ITS SURVEILLANCE.

(Osaka no taiki osen no genjo to Kanshitaisaku).
Text in Japanese. Netsu Kanri (Heat Management: Energy and Pollution Control), 22 (8):11-19, Aug. 30, 1970.
Shoichi Hagino.
Identifiers: *Osaka, *Sakai, *Air quality measurements, Abatement, Control programs, Seasonal, Japan, Streets, Urban areas, Commercial areas, Industrial areas, Residential areas, Automotive emissions, Combustion products, Dusts, Suspended particulates, Automobiles, Dust fall, Lead peroxide candle, Electroconductivity analyzers, Samplers, Winds, Carbon monoxide, Sulfur dioxide.

The trends and data of various types of air pollution mainly in Osaka and Sakai are described. The lead dioxide candle measurements of sulfur dioxide in 1967 and 1968 showed that most of Osaka has the average sulfur dioxide pollution of about 1.50 mg/100 sq cm/day, and it is generally more severe in summer than in winter. The measurement of settling dusts by dust jars indicate that in Osaka the dusts are decreasing over the years, but in Sakai they are gradually increasing to values as high as 20 tons/year. Carbon monoxide was monitored by mobile stations at heavy traffic locations, and the 24-hour average maximum of over 10 ppm was recorded at Nanba Station. Although at the central parts of Osaka and at major street intersections the concentrations were as high as 10 ppm, at residential areas and points away from intersections the measurements were around 5 ppm. In view of the environmental standard for carbon monoxide, the data indicate that in the central district of Osaka, the heavy traffic pattern may not allow the concentration to stay within the limits on days with low wind speed. In addition, the Blue-Sky Project Nos. 1 and 2 promoted by Osaka Prefecture and the Ministry of International Trade and Industry are described.
APTIC-23811

### THE ANNUAL VARIATION OF TOTAL OZONE IN THE SOUTHERN HEMISPHERE.

Monthly Weather Rev., 98 (10):787-788, Oct. 1970. 7 refs.
Philip R. Sticksel.
Identifiers: *Southern hemisphere, *Air quality measurements, *Ozone, Annual, Monthly, Seasonal, Dispersion, Atmospheric movements.

A summary of Southern Hemisphere total ozone measurements made monthly during the quiet sun period of 1960-1965 showed no pronounced changes from the annual variation pattern observed during the preceding active-sun years. Nor was any difference found during 1960-1965 between the annual variation of total ozone in the South Pacific area and the annual trend at other longitudes in the Southern Hemisphere. The present analysis does reemphasize that dissimilarities in the development pattern of the springtime ozone maxima in the Southern and Northern Hemispheres require that the ozone general circulation models be different in the two hemispheres. The principal features of the annual distribution of ozone are discussed. (Author abstract modified)
APTIC-23841

### RESULTS OF A FIVE-YEAR INVESTIGATION OF AIR POLLUTION IN CINCINNATI.

Arch. Ind. Hyg. Occupational Med., Vol. 6:314-325, 1952. 3 refs. (Presented at the American Industrial Hygiene Association, Air Pollution Division, Annual Meeting, 13th, Cincinnati, Ohio, April 24, 1952.)
J. Cholark, L. J. Schafer, and R. F. Hoffer.
Identifiers: *Cincinnati, *Suspended particulates, *Chemical composition, Air quality measurement programs, Monthly, Seasonal, Urban areas, Automotive emissions, Odors, Air quality measurements, Dust fall, Measurement methods, Intermittent monitoring, Electrostatic precipitators, Meteorology, Aldehydes, Ammonia, Chlorides, Fluorides, Metal compounds, Nitrates, Carbon dioxide, Carbon monoxide, Sulfur dioxide.

The results of an air quality investigation in Cincinnati, Ohio are presented. Samples were taken at 18 sites, several times monthly for a period of five years. At each of the stations, samples of suspended matter were collected by an electrostatic precipitator and were analyzed several ways to determine the composition of the particulate matter suspended in the atmosphere. Compounds identified included various metals, sulfur dioxide, fluorides, chlorides, carbon monoxide, carbon dioxide, aldehydes, nitrates, and ammonia. In addition, measurements of odors and dust fall are reported. Relationships between pollutant concentration and traffic density, season, and meteorological conditions are discussed. Plans for the continuation of the monitoring network are described.
APTIC-23845

### ENVIRONMENTAL POLLUTION IN OSAKA PREFECTURE.

54p., April 1970.
Personal Author Not Recorded.
Identifiers: *Legislation, *Osaka prefecture, *Air quality measurements, Abatement, Control agencies, Regional governments, Annual, Japan, Urban areas, Commercial areas, Industrial areas, Suspended particulates, Water pollution, Dust fall, Carbon monoxide, Sulfur oxides.

As a result of postwar developments, Osaka is now the most active commercial and industrial region in western Japan. In this area, the responsibility for administering and enforcing Japanese laws pertaining to the control of environmental pollution belongs to Environmental Pollution Control Center of the Prefectural Government Results are presented of the Center's surveys on the current status of air pollution, water pollution, and noise in the region. Included are measurements of average dust fall from April 1968 to March 1969, suspended particulate and sulfur oxides concentrations from April 1968 to March 1969, one-hour average carbon monoxide levels, and a chart of the correlation between the sulfur oxides emission rate and relative concentration levels. Also shown is the yearly variation in measured dust fall between 1959 and 1969. The sulfur oxides measurements are compared with the national standards established in February 1969. Percentage reductions expected to be achieved with appropriate control measures are noted. With respect to water pollution, biological oxygen demand levels are reported for Osaka Bay and main area rivers. Abatement measures include not only regulation by laws and ordinances but a joint treatment program for plant effluents. Mean levels of environmental noises between December 1968 and January 1969 are shown. The noises are categorized according to zone and industry, and the scope of the noise regulation law is outlined.
APTIC-23847

### FLUORIDES AND CHLORIDES IN PRECIPITATION SAMPLES IN BOHEMIA.

(Fluoride und Chloride in Niederschlaegen von Boehmen). Text in German. Stud. Geophys. Geod., vol. 11:241-251, 1967. 33 refs.
Roman Valach.
Identifiers: *Precipitation, *Chlorides, *Fluorides, *Bohemia, Europe, Germany, Volcanoes, Coal, Air quality measurements, Analytical methods, Fog, Humidity, Hydrofluoric acid, Chlorine, Fluorine.

Analysis of results of fluoride and chloride content determinations in precipitation samples in Bohemia disclosed that, in samples containing ash, the halogens came mostly from the ash while in samples that contained little or no ash the halogens came from the atmosphere. The atmospheric levels of F and Cl were unaffected by the intensity of coal combustion and it is doubtful that industrial emission is the principal source of Cl and of F in precipitation. These findings seem to confirm the hypothesis that both Cl and F in the atmosphere are mainly of volcanic origin and originate from exhalations of highly hygroscopic chlorides and fluorides. Hydrofluoric acid forms heavy fogs with humidity which can be observed in the north Bohemian coal basin where the coal is rich in F. The Cl/F ratio in precipitation was found to be approximately 10, the same ratio in volcanic gases in approx. 6.
APTIC-23862

### PB210 IN SURFACE AIR ALONG THE SLOPES OF MAUNA LOA VOLCANO, HAWAII. (FINAL REPORT).

Stanford Univ., Calif., Dept. of Civil Engineering, AEC Contract AT (04-3)-326-PA16, SU TR-117, 22p., Sept. 1969. CFSTI: SU 326-PA-16-3
Paul Kruger.
Identifiers: *Air quality measurements, *Lead compounds, *Isotopes, Hawaii, Oceans, Volcanoes, Altitude, Ground level, Lower atmosphere, Transport, Winds, Inversion, Strontium compounds, Aerosols, Hi-vol samplers.

During one-week periods in the summers of 1966 and 1967, atmospheric aerosols were collected in high-volume samplers located at ground-level sites in Hawaii and along the slopes of volcanoes. The samples were analyzed for Pb210 and Sr90. At one site, air samples were collected in evacuated bottles and analyzed for radon. The general concentrations of Pb210 in Hawaii surface air are by no means low compared to concentrations over continental land masses. The comparatively large values suggest that little Pb210 is removed from the atmosphere during wind transport over the open ocean. Unlike Sr90 concentrations, which were essentially constant at all heights, the Pb210 concentrations decreased up to about the altitude of normal trade wind inversions and showed a marked increase above inversion height. The negative gradient of Pb210-Sr90 concentration ratios suggests a contribution to the Pb210 concentration by decay of Rn222 from local sources. The mean residence time of Rn222 was 0.5 hrs in 1966 and 3.75 hrs in 1967.
APTIC-23864

### PRINCIPLE SOURCES OF POLLUTION.

(Le principali fonti di inquinamento). Text in Italian. In: L'Inquinamento atmosferico in Italia. Rept. 27, p. 7-145, 1970. 110 refs.
Luigi Mammarella.
Identifiers: *Sources, *Air quality measurements, Monthly, Seasonal, Cements, Italy, Urban areas, Chemical processing, Petroleum refining, Steam plants, Mineral processing, Primary metallurgical processing, Domestic heating, Vehicles, Automobiles, Inversion, Sulfur dioxide.

Air pollution sources are summarized under the headings of home heating, industrial sources (cement industry, thermoelectric plants, petroleum industry, metallurgical plants, chemical industries), and motor traffic. Due to the frequent oc-

currence of inversions in the Milan area, the sulfur dioxide concentration in the lower layers of the atmosphere itensify as one reaches the center of the city, where the average monthly figures reach 0.4 ppm, with occasional values above 1.5 ppm., which is experienced with more frequency than in Paris or London. At Turin, the values range between 0.2 and 0.4 ppm in the winter, while the summer value is 0.01. The concentrations at Padua are in the range of 0.4 - 0.2 ppm. Concentrations at Rome during the winter are in the range 0.07-0.1 ppm, while at Salano there is practically no SO2 in the air at any time of the year. Italy has 120 cement plants, with a heavy concentration in the Po Valley. There are 347 thermoelectric plants, ranging in output from 1 MW to 600 MW. Figures for 1967 give 38 petroleum refineries with a total capacity of more than 140 million tons. An estimate based on parallel statistics from the USA gives a figure of 86 million tons of pollution created by automotive traffic in the year 1966, which would constitute about 60% of total emissions.
APTIC-23881

### THE IMPORTANCE OF INVESTIGATING GLOBAL BACKGROUND POLLUTION.

In: Meteorological Aspects of Air Pollution. World
Meteorological Organization, Geneva
(Switzerland), Rept. WMO 251, TP139, TN106, p.
31-54, 1970. 9 refs.
Erik Erikkson.
Identifiers: *Air quality measurement programs, *Europe, Annual, Sweded, Chemical composition, Sampling methods, Precipitation, Ammonia, Chlorides, Calcium compounds, Magnesium compounds, Potassium compounds, Sodium compounds, Nitrates, Sulfates, Electrical properties, Ph.

In 1946, on the initiative of the Swedish Meteorological and Hydrological Institute and the Agricultural College of Sweden, a network of stations was organized for studying the chemical composition of precipitation; two years' investigations showed strong geographical variation in the concentrations of ammonia and nitrate in precipitation. After a few years this network was reduced in size but equipment for air sampling was added, so that both air and precipitation compositions could be studied. The analyses now comprised sodium, potassium, calcium, magnesium, ammonia, chloride, nitrate, sulfate, alkalinity, acidity, and electrical conductivity. Similar networks were organized in a number of countries in western Europe and in the U.S.A. A map of locations of stations in the west-European area that have been operated for at least nine years is presented. Equipment used in the west-European networks consists of a funnel of resistant glass, a storage bottle of polyethylene, and a bird protection device to prevent undue contamination. When fifteen graphs with the results of the data collected over a number of years were interpreted, no clearcut trends in pollution concentration were revealed. Deviations from year to year are large, which is not unexpected in Western Europe, as this area is located on the border of a strong pollution source subjected to westerly circulation.
APTIC-23959

### REGIONAL DIFFERENCES IN THE DEPOSITION OF HEAVY METALS OVER SCANDINAVIA.

(Regionala skillnader i nedfallet av tungmetaller
oever Skandinavien). Text in Swedish. Lund
Univ., Sweden, Inst. of Ecological Botany, Rept.
10, 23p., Feb. 1970. 7 refs.
Ake Ruhling, and Germund Tyler.
Identifiers: *Area surveys, *Scandinavia, *Dust fall, *Metal compounds, Plants (botany), Sweden, Air quality measurements, Dustfall, Transport, Rain, Cadmium compounds, Calcium compounds, Chromium compounds, Cobalt compounds, Copper compounds, Iron compounds, Lead compounds, Magnesium compounds, Manganese compounds, Nickel compounds, Potassium compounds, Sodium compounds, Zinc compounds.

The metal content in a common sort of moss is investigated, revealing an evident difference between southern Sweden and northern Scandinavia. A distinct increase in lead is observed in the southern regions of the study, indicating that lead must be transported from Western Europe by air. The greatest industrial sources of lead in Sweden are in the north. Concentrations of calcium, cadmium, cobalt, chromium, copper, iron, potassium, magnesium, manganese, sodium, nickel, lead, and zinc are measured. A distinct correlation between rainfall and metal concentration is observed.
APTIC-23971

### FORMALDEHYDE DETERMINATION IN THE URBAN ATMOSPHERE.

(Formaldehyd-Bestimmungen in Strassenluft).
Text in German. Gesundh. Ingr., 89 (1):18-21,
1968. 17 refs.
E. Lahmann, and K. Jander.
Identifiers: *Formaldehydes, *Urban areas, *Spectrophotometry, Germany.

Formaldehyde in the 2-50 gamma/cu m concentration range is absorbed to 98% in distilled water when drawn at 150 l/hr through a porous glass bottom washing flask. To each ml of this solution is added 0.1 ml of 0.05 M sodium tetrachloromercurate (I) containing 0.1 mg sodium sulfate, and 0.1 ml solution containing 0.16 mg pararosaniline and 10 mg hydrochloric acid. Spectrophotometric evaluation was made after 1.5 hrs at 20 deg, as the color change is at its slowest. Formaldehyde, 0.3 gamma can be detected in 25 ml solution or 2 gamma/cu m in the air by 1 hr sampling. The standard deviation was from 3-50 gamma/cu m at a concentration of approximately 4.5% formaldehyde. The determination can be made in the presence of AcH, Me2CO, EtOH, nitrite, sulfide, and sulfite.
APTIC-23978

### RESEARCH CONCERNING VEHICLE EXHAUST AND LETTERS.

Stockholm Univ. (Sweden), Inst. for Analytical
Chemistry, 1969. Translated from Swedish. Belov
and Associates, Denver, Colo., 42p., June 19,
1970.
Gunnar Widmark, and Anders Laveskog.
Identifiers: *Urban areas, *Engine exhausts, *Air quality measurements, *Lead compounds, Research programs, Sweden, Streets.

Notes pertaining to research on the amount of organic lead pollutants in the streets (city air) are enclosed. Possible research problems are suggested and include improving analytical methods to determine tetramethyl and tetraethyl lead in the same tests; improving the possibility to monitor reactions or converted products from TML/TEL; how much of the TML/TEL which is breathed is absorbed by the body and are the isotopic combinations of lead which are isolated from human blood distinguishable from the common mine lead in that district. Several comments concerning the test procedure are cited for the research analyst.
APTIC-24031

### THE NATIONAL AEROMETRIC DATA BANK.

Preprint, Air Pollution Control Association,
Pittsburgh, Pa., 20p., 1970. 7 refs. (Presented at the
Air Pollution Control Association Annual
Meeting, 63rd, St. Louis, Mo., June 14-19, 1970.)
Gerald J. Nehls, Donald H. Fair, and John B.
Clements.
Identifiers: *National aerometric data bank, Data-handling systems.

The National Aerometric Data Bank channels valid aerometric data in both directions among Federal, state, and local agencies. The flow of data into and out of the Bank, including data preparation, validation, updating, processing, and retrieval operations, is handled by the Storage and Retrieval of Aerometric Data System (SAROAD). For incorporation in the Bank, data must (1) be representative of a consecutive three-month period, (2) an interval of one hour or greater (i.e., no more than 24 values per day), (3) characterize ambient levels in an area or neighborhood; and (4) be validated and in the same metric units as NAPCA's aerometric data. Presently, valid air quality data representing some 500 sampling sites are incorporated in the Bank. An intensified program is now underway to acquire all additional valid data on a nationwide basis and convert it to the SAROAD format for storage in the Bank. It is hoped that in the future all agencies will have the ability to accept as well as generate data in the SAROAD format. This capability is essential to Air Quality Control Regions. A brief discussion of SAROAD coding structures is given along with examples of input and output formats.
APTIC-24121

### URBAN AIR POLLUTION BY VEHICLE EXHAUST GASES AND ITS COUNTERMEASURE (I).

(Jidosha haigasu niyoru toshiosen to sono taisaku
(I)). Text in Japanese. Kogai to Taisaku (J.
Pollution Control), 6 (9): 715-721, Sept. 15, 1970.
Yoshitaka Kobayashi.
Identifiers: *Urban areas, *Automotive emissions, *Air quality measurements, Annual, Hourly, Streets, Automobiles, Ground level, Lower atmosphere, Dispersion, Winds, Inversion, Carbon monoxide, Nitric oxide (no), Nitrogen dioxide (no2), Sulfur dioxide, Ozone.

The present state and some characteristics of urban air pollution by motor vehicle exhaust emissions are discussed. Some general trends are noted regarding the atmospheric carbon monoxide concentration and other atmospheric components and factors. The horizontal distribution of ambient CO at street level shows the highest concentration at a point above the street. The concentration gradually decreasing with increasing distance. The same trend is also observed with vertical distribution, though exceptions occur under some meteorological conditions in metropolitan areas. Where wind speed is relatively slow during the day and where lower atmospheric inversions continue until afternoon. Variations in CO concentration are noticeable up to 100 m. The carbon monoxide concentration in streets is generally directly proportional to traffic volume. In terms of physicochemical reactions and effects on pollution processes, atmospheric pollutants can be classified as four groups: suspended particles, sulfur dioxide and nitrogen dioxide, carbon monoxide, nitric oxide and ozone. Each group appears to have a different pollution pattern. The annual average CO value at intersections is between 3 and 8 ppm but hourly values occasionally exceed 40-50 ppm. In metropolitan areas with large numbers of motor vehicles, (e.g., Osaka, 2057/sq km and Tokyo 1875/sq km) high CO levels tend to occur with wind velocities 0.5-1.0 m/sec and with active temperature inversions in the lower atmospheric layer. The findings reported are summarized in tables and graphs.
APTIC-24158

### AIR POLLUTION FROM MOTOR VEHICLES IN NEW ZEALAND.

SAE-Australasia, 30 (4):136-142, July-Aug. 1970. 6
refs. (Presented at the Vehicle Exhaust
Symposium, Auckland, New Zealand, April 15,
1970.)
Norman G. Thom.
Identifiers: *New zealand, *Automotive emissions, *Air quality measurements, Carboxyhemoglobin, Carcinogens, Streets, Urban areas, Residential areas, Odors, Smog, Diesel engines, Spark ignition engines, Vehicles, Monitoring, Hydrocarbons, Lead compounds, Carbon monoxide, Nitrogen oxides, Photochemical reactions.

Air pollution monitoring in New Zealand, particularly in Auckland, has indicated that levels of pollution originating from motor vehicles are comparable with those of similar sized cities in developed countries. Carbon monoxide affects the

body by combining with the hemoglobin of the blood to form carboxyhemoglobin, thus decreasing the ability of the blood to carry oxygen to body cells. The maximum two hour concentration measured in Auckland would result in approximately 3% of a person's hemoglobin being combined with CO if he were a non-smoker and stayed in the area where the measurements were taken for two hours. The major significance of the oxides of nitrogen in air pollution is the role they play in the formation of photochemical smog. Average 24 hour concentrations in Auckland range from 0.4 pphm in the outer suburbs to 9.0 pphm in the city streets. Hydrocarbons no doubt include many of the gases which give rise to traffic odors, while some of the ring shaped compounds are known carcinogens. The main significance of the hydrocarbons emitted in the exhaust gases is that they contain many unsaturated compounds which are very reactive in the processes which give rise to photochemical smog. However, Auckland has neither the topography nor meteorology likely for promoting this type of phenomenon. Values of airborne lead range from peak concentrations of 6.0 micrograms/cu m in city streets to an average 0.6 micrograms/cu m in residential areas. Lead is to some degree a cumulative poison in the human body. Generally, a well maintained diesel that is not overloaded gives rise to less air pollution than an equivalent gasoline vehicle. Control of air pollution from automobiles is also mentioned.
APTIC-24162

## 5. ATMOSPHERIC INTERACTIONS

### RELATION BETWEEN AIR POLLUTION IN OSAKA AND ANTICYCLONE.

(Osaka ni okeru Taiki Osen to Kokiatsu no Kankai.) Text in Japanese. Kishocho Kenkyu Jiho (Journal of Meteorological Research) (Tokyo), 20 (12):647-651, 1968. 6 refs.
H. Harada.

Identifiers: *Japan, *Anticyclones, *Sulfur dioxide, Asia, Pollutants, Particulates, Settling particles, Dusts, Statistical analyses, Atmospheric phenomena, Meteorology, Atmospheric movements, Winds, Sea breeze, Sulfur oxides.

The effects of anticyclone behavior in Osaka were studied from November, 1965 to March 1966. The cumulative frequencies of 24-hr mean concentrations of SO2, daily maximum and minimum concentrations of SO2, and smog durations, i.e., duration or higher SO2 concentration than 0.2 ppm or duration of higher dust concentration than 1.0 mg/cu m were obtained and statistically analyzed. The results indicate that the longer the anticyclone stagnates over Japan, the higher the concentrations of SO2 and dust will be. This is partly interpreted from the effects of land and sea breezes, which discourage the diffusional effects of SO2 and dust concentrations.
APTIC-18279

### THE RESULT OF OBSERVATION ON PLUME RISE.

(Hai Gasu Joshoko No Jisoku Kekka.)
Meteorological Research Inst., Tokyo (Japan). Applied Meteorology Laboratory, 14p., 1968. 5 refs. Translated from Japanese.
Junji Sato.

Identifiers: *Stacks, *Measurement methods, *Plume behavior, Japan, Cameras, Experimental methods, Dispersion, Stability (atmospheric), Neutral condition.

The plume rises from industrial chimneys 55, 90, 120, and 170 meters in height were examined and attempts made to fit the empirical data to existing correlations for dispersion and effective stack height. These were used to describe the spreading pattern of the high-temperature plume as it left the stack, an important factor in determining the pollutant concentration on the ground. Photographs of the tracer-colored plume were taken at 40-second intervals. The axis of smoke flow was observed from a helicopter. Additional observation points on the ground gave sufficient data to calculate trigonometrically the position of the trail. The plume temperature and rise velocity at the stack exit, and the wind velocity, were also determined. The Priestley equation for plume rise was used for the determination of the maximum rise height for heat-dependent, neutral-layered conditions, and for a stable condition. It was found that stacks taller than 100 meters contacted atmospheric layer movements and had practically no unstable condition. Empirical findings were compared with results calculated from the Holland (Oak Ridge), Bosanquet, and Priestley equations. The Holland correlation was satisfactory for large heat emissions, and the Bosanquet equation gave inconsistently high values. The Priestley equation was good for small heat emissions. When empirically corrected for wind velocity, stack height, and heat emission, the correlation gave the plume rise in terms of experimentally determined factors for netrual layer conditions.
APTIC-18307

### PHOTOCHEMICAL OXIDATION OF SULFUR DIOXIDE IN AIR.

Ind. Eng. Chem., 47 (5):972-976, May 1955. 16 refs.
Earl R. Gerhard, and H. F. Johnstone.

Identifiers: *Sulfur dioxide, *Photooxidation, Droplets, Visibility, Fog, Humidity, Sulfuric acid, Ultraviolet radiation, Reaction kinetics.

The rate of the photochemical oxidation of sulfur dioxide in air was determined in the concentration range 5 to 30 ppm. The reaction was carried out in a Lucite cylinder in which the reaction mixture was exposed to ultraviolet light in the range from 3650 to 2950 A, and the sulfuric acid drops formed as a result of the reaction were collected by a microtechnique involving impaction on an indicator film. The reaction is first order with respect to sulfur dioxide, and the rate is unaffected by the humidity, the presence or absence of salt nuclei, or by the concentration of nitrogen dioxide, in the ranges studied. The rate in artificial sunlight was in the order of 0.68% per hour and the mass median diameter of the particles was 0.19 to 0.45 microns. A few measurements in natural sunlight indicate the reaction rate to be approximately 0.1% per hour. Gas phase oxidation of sulfur dioxide of naturally polluted atmospheres in natural sunlight would not be significant in effectively reducing the visibility, since it would require approximately 100 hours of intense noon sunlight to reduce the visibility to 1 mile. Other types of oxidation, such as the liquid phase reaction in fog droplets, or a combination of gas phase and liquid phase reactions at high humidity, may be more effective in reducing the visibility. These are being investigated. (Author abstract modified)
APTIC-22191

### STUDY OF THE SO2 OXIDATION IN SOLUTION AND ITS ROLE IN ATMOSPHERIC CHEMISTRY.

Quart. J. Roy. Meteorol. Soc. (London), vol. 84: 46-55, 1958. 12 refs.
E. Junge, and T. G. Ryan.

Identifiers: *Sulfur dioxide, *Sulfates, *Oxidation, Fog, Rain, Pressure (atmospheric), Ammonia, Catalytic activity, Reaction mechanisms, Ph.

The mechanism of sulfur dioxide oxidation in diluted catalytic solutions was studied. Oxidation was found to stop after a certain pH value was reached. In the same catalytic solutions, the maximum possible sulfate radical formation is a linear function of the SO2 partial pressure in the air. This mechanism of sulfate radical formation can account for observed sulfate radical concentrations in rain, fog, and smog only if some neutralizing cations in the aerosols or traces of ammonia in the air are present. In the latter case the system SO2-NH3-catalytic solution can explain the main features of sulfate radical formation in our atmosphere. (Author abstract modified)
APTIC-22192

### AIR POLLUTION AND ANKARA'S METEOROLOGICAL ASPECTS.

(Hava kirlenmensi ve Ankaranin meteorolojik durumu). Meterol. Isleri Genel Mudurlugu Yayinlari, 1969:1-16. 3 refs. Translated from Turkish. Belov and Associates Denver, Colo., 16p., May 29, 1970.
Personal Author Not Recorded.

Identifiers: *Pollutants, *Meteorology, Planning and zoning, Trees, Europe, Urban areas, Engine exhausts, Stack gases, Particulates, Smog, Smokes, Visibility, Winds, Clouds, Fog, Humidity, Rain, Temperature (atmospheric), Inversion.

Meteorological aspects of air pollution in Ankara, Turkey, are discussed. Fires for various purposes, smoke from industrial plants, and exhaust fumes from motor vehicles cause a large amount of toxic substances to mix in the air. Among the gaseous pollutants, carbon monoxide, sulfur dioxide, and nitrous oxide are the most important. Particulates in the air in large cities vary between 0.3 and 0.9 mg/cu m. The presence of dust affects solar radiation, reduces vision, and causes fog conditions to develop. Heat induction and rising hot air in the cities causes cloud formation, while the presence of hygroscopic particles facilitates the rapid formation of clouds. Therefore, rainfall in the cities shows a 10% increase in comparison with the surrounding area. A study was conducted on ground inversion, heat variances between its top and bottom layers, and the winds flowing at 300 m above the ground. It is recommended that the industrial center be moved towards the ESE and SSE section of the city since no inversion was found in winds blowing from a different direction. Trees should be planted in polluted areas since they create a thermal circulation and act as dust filters. Electrically powered public transportation systems are recommended to replace those using diesel and gasoline engines. Priority should be given to designing main streets of a city so that they are parallel to the direction of the prevailing winds.
APTIC-22193

### SOURCES AND REACTIVITY OF LIGHT HYDROCARBONS IN AMBIENT AIR.

Proc. Am. Petrol. Inst., Sect. III, 1967:466-483, 1967. 10 refs. (Presented at the Am. Petrol. Inst., Div. Refining Meet., Los Angeles, Calif., 1967.)
Edgar R. Stephens, Ellis F. Darley, and Frank R. Burleson.

Identifiers: *Olefins, *Propanes, *Solar radiation, Engine exhausts, Natural gas, Petroleum production, Flame ionization detector, Photochemical reactions, Reaction kinetics.

Recent measurements of low molecular weight hydrocarbons in ambient air samples are described, using flame ionization detection. The disappearance of individual hydrocarbons under irradiation with artificial and natural sunlight in such samples was also measured. Auto exhaust irradiation was included. Substantial reaction of both olefins and paraffins occurs during the course of one day's irradiation. Although the reactivity of the olefins is higher than that of the paraffins the latter group makes a significant contribution to total reactivity because the amount initially present is relatively large. The anomalously large amounts of the lightest paraffins (propane in particular) were further investigated by analyzing samples near and far from oil fields. The results do not clearly reveal the source of these paraffins but it seems probable that gasoline evaporation, natural gas leakage, and oil field losses may all contribute. A correlation technique permitted the identification of natural gas in some sets of early morning ambient air samples. (Author abstract modified)
APTIC-22196

### CONSIDERATION OF A SIMPLIFIED ESTIMATE OF THE TURBULENT DIFFUSION OF STACK GAS ACROSS A TRACT OF LAND.

(Beruecksichtigung vereinfachter Gelaendetypen
bei der Berechnung der turbulenten Ausbreitung
von Schornsteingasen). Text in German. Staub
(Duesseldorf), 24 (5):175-182, May 1964. 7 refs.
Hermann Stuemke.
Identifiers: *Stack gases, *Diffusion models, Germany, Stacks, Turbulence (atmospheric), Fluid flow.

The propagation of a harmful gas in a two-dimensional flow across a tract of land transverse to the flow is considered. If the diffusion is also two-dimensional, one formally obtains the same solutions as for a plane earth by going over from geometrical to flow co-ordinates. In the case of three-dimensional diffusion, however, this only applies with the use of an additional assumption. The correction factors calculated with this for the effective chimney height are dependent only on the envelope of the flow field and not on the flow velocity or diffusion coefficients. (Author abstract)
APTIC-22221

### THE ROUND TURBULENT JET IN A CROSS-WIND.

J. Fluid Mech., 15 (4):481-497, April 1963. 12 refs.
J. F. Keffer, and W. D. Baines.
Identifiers: *Jet, *Winds, *Turbulence (atmospheric), Canada, Mathematical analyses, Plume behavior, Fluid flow.

The flow of a jet directed normal to a uniform, steady cross-wind is considered. Experimental investigation in a low-speed air tunnel shows that for various jet strengths, the position of the jet in space, when stretched by the ratio of jet to cross-wind momenta, is described by a single function. Exceptions exist at very low velocity ratios where a shift of the potential core is evident. A natural system of axes is used to define important directions of the flow. The integrated equation of motion along the primary jet flow direction is made dimensionless after the general method of Morton (1961) and a virtual source is defined for the flow. A single functional behavior of the axial jet velocity exists for various velocity ratios if the jet is considered to originate from this source. Lateral velocity profiles show a similarity when scaled by appropriate lengths and velocities but true self-preservation is not attained. (Author abstract modified)
APTIC-22225

### SCAVENGING OF ATMOSPHERIC PARTICLES BY ICE CRYSTALS.

J. Atmospheric. Sci., 24 (5):533-538, Sept. 1967. 24 refs.
Ottavio A. Vittori, and Vittorio Prodi.
Identifiers: *Scavenging, *Aerosols, *Ice, Italy, Mathematical analyses, Clouds, Condensation, Supercooling, Particle growth, Water.

Ice crystals growing in supercooled clouds were studied in a Nakaya chamber to determine their ability to include foreign particles in their structure. Zinc sulfide particles were used as test aerosols. In a series of experiments on wash-out ratios of condensing water and growing ice, ice crystals proved to be 16 times more efficient than water in capturing atmospheric particles. The existence of Facy's 'dust-free space' around evaporating surfaces was confirmed. Dust-free space around supercooled droplets is considered, in connection with Stefan flow, to be an important mechanism in bringing particles toward ice surfaces, and may account for the observed wash-out efficiency of ice crystals. (Author abstract modified)
APTIC-22226

### CONDENSATION NUCLEI IN THE AIR OF ARTIFICIALLY HEATED ENVIRONMENTS.

(I nuclei di condensazione nell'aria degli ambienti
artificialmente riscaldati). Ann. Sanita Publica
(Rome), vol. 13:1569-1581, Nov.-Dec. 1952. 20 refs.
Translated from Italian. Franklin Inst. Research
Labs., Philadelphia, Pa., Science Info. Services,
20p., Dec. 16, 1969.
Daniele Parvis.
Identifiers: *Buildings, *Domestic heating, *Condensation (atmospheric), *Nucleation, Bioclimatology, Nostrils, Sinuses, Trachea, Italy, Humidity, Pressure (atmospheric), Condensation, Temperature (atmospheric).

An investigation was conducted to establish numerical values of condensation nuclei in the air of artificially heated environments. The number of condensation nuclei was determined with an Aitken counter, and an Owens jet dust counter was used to determine the particle content of the air. Basic climatic factors including temperature, humidity, air movement, and atmospheric pressure were measured. The outdoor air in the center of Milan between 11 am and 1 pm from January to March 1952 contained an average of 100,000 condensation nuclei/cc. Inside the rooms investigated, the number of nuclei was approximately 50% lower and fluctuated between 32,000 and 74,000/cc. The lowest levels of condensation nuclei were found in air-conditioned and electrically heated rooms and highest levels prevailed in environments heated by coal stoves associated with dryness and irritation of the mucous membrane of the upper airways. It is believed that data on nucleation represent useful parameters of air hygiene in different environments. Further studies on ionization and nucleation are required to define the climatic factor which influence well-being in confined rooms.
APTIC-22228

### WIND DIRECTION, TURBULENCE, AND SMOKE SPREADING IN A VALLEY AND ELEVATED PLAIN.

(Wind, Richtungsboeigkeit und Rauchausbreitung
in Tal- und Hochflaechenlage). Text in German. Z.
Meteorol., 18 (8-10):330-352, 1966. 42 refs.
G. Flemming.
Identifiers: *Plume behavior, *Winds, *Topographic interactions, *Turbulence (atmospheric), Diurnal, Seasonal, Germany, Plains, Valleys, Smokes, Ground level, Diffusion.

Wind speed, wind direction, and lateral gustiness measured in a valley is compared with corresponding data from surrounding elevated plains. The data are obtained by slightly modified version of the usual Junkalor wind recorder. The wind regime at the valley bottom is a function of the wind direction and rate of turbulence of the current. The Lowry directional correlation index is computed. Lateral gustiness is illustrated by its diurnal variation and as a function of wind speed and wind direction. Normally the turbulence in the valley is reduced by 1) reduced wind speed, 2) smoothing effect by the valley walls, and 3) higher thermal stability. With clear-sky and low-wind conditions, the turbulence in the valley is most reduced; with increasing wind, turbulence increases, as the valley plays the role of a disturbance to the flow in view of the size of the turbulence elements. This is encountered in winter more frequently than in summer, and is most conspicuous with a flow direction at a slant angle towards the valley's orientation. The conditions are, compared with the open terrain, most undesirable in the valley when clear and nearly calm weather prevails. Climatologically, the valley is a smoke directrix. The most favorable shape and orientation of the valley are discussed. (Author abstract modified)
APTIC-22233

### ATMOSPHERIC DIFFUSION OF PARTICULATE MATTER RELEASED FROM AN ELEVATED CONTINUOUS SOURCE.

J. Appl. Meteorol., 7 (3):425-432, June 1968. 12 refs.
Robert E. Stewart.
Identifiers: *Stacks, *Dust fall, *Plume behavior, Particle counters, Particle size, Mathematical modeling, Simulation, Ground level, Diffusion models, Winds, Temperature gradient.

Dustfall simulation experiments were conducted to estimate the ground-level deposition pattern. Batches of different size glass microspheres (50-200 microns were continuously released into the atmosphere from an elevated point source. Samplers were placed at ground level along arcs downwind from the stack and the particles were subsequently identified and counted. Measurements of wind speed, gustiness and temperature gradient were made. The data and data obtained by previous investigators were compared with theory. Two mathematical models were used in the comparison: a three-dimensional classical model by Denisov (comparable to Rounds's two-dimensional solution), and a three-dimensional statistical model by Csanady. Both models assume steady-state conditions, horizontal homogeneity, linear growth relationships for the plume dimensions, and complete particle retention at the ground. The deposit pattern can be predicted reasonably well by the statistical model but should be restricted to values of f/and f/sigma (w) (u is the mean wind speed, f the particle terminal velocity, and sigma (w) the rms value of the vertical velocity fluctuations of the turbulent field) greater than 0.05 and 1.0, respectively. At lower values of these ratios, the statistical model overestimates the maximum deposition and underestimates its location. The classical model, in general, underestimates the maximum deposition by a factor of approximately 1.5. (Author abstract modified)
APTIC-22256

### A STUDY OF SEA-SALT PARTICLES OVER PUERTO RICO.

J. Meteorol., 12 (5):493-499, Oct. 1955. 17 refs.
(Presented at the American Meteorological
Society, 128th National Meeting, Baltimore, Md.,
April 30, 1954.)
James P. Lodge.
Identifiers: *Sea salts, *Dispersion, Oceans, Altitude, Ground level, Lower atmosphere, Precipitation, Chlorides.

A total of 11 flights were made between December 12, 1953 and April 16, 1954 for the purpose of measuring chloride particle concentrations at various altitudes near Puerto Rico. Ground-level collections were also taken. The evaluation of the flight collections indicated that the particles follow a Boltzmann-type distribution with altitude and that concentrations decrease from 500 to 100 ft. The measurements thus substantiate other findings that large sea-salt nuclei occur in sufficient concentrations at cloud level over the ocean to account for the initiation of precipitation. This mechanism, however, may not be effective very far inland: the ground collections show a general downward trend, with the largest particles decreasing most rapidly in concentration with increasing distance from the sea.
APTIC-22263

### PHOTOLYSIS OF AMMONIUM NITRATE SOLUTIONS BY SUNLIGHT.

Ric. Sci., 37 (11):979-983, Nov. 1967. 16 refs.
Gianna L. Petriconi, Enrico G. Gori, and Henry
M. Papee.
Identifiers: *Ammonium compounds, *Nitrates, *Photolysis, *Solar radiation, Italy, Altitude, Ground level, Lower atmosphere, Nitrites, Reaction kinetics.

Field experiments were conducted to study the photolysis by sunlight of aqueous ammonium nitrate solutions (15.0 and 25.0 percent). Six kinetic runs were carried out on each solution at altitude levels of 0, 1040, 2040, 2660 (two series), and 2500 meters; five measurements were taken per run. The experiments were performed on perfectly cloudless days, starting at 08 hours am throughout. The results are illustrated in curves of

nitrite formation with time and elevation. The curves demonstrate the role which concentration, radiation and/or temperature exert on rates of nitrite formation in aqueous solutions of ammonium nitrate. It is concluded that aerosols containing ammonium nitrate, which is known to be a good natural fertilizer, are photolyzed by the near ultraviolet component of solar radiation, yielding ultimately water, nitrogen, and nitrous oxide, which are of no fertilizing value. Because of the presence of chlorides, the reaction is likely to be enhanced by mountainous or maritime climatic conditions.
APTIC-22272

### MICROMETEOROLOGY.

Sci. Am., 211 (4):62-70, 75-76, Oct. 1964.
Graham Sutton.
Identifiers: *Micrometeorology, Diurnal, Plants (botany), Smokes, Stacks, Ground level, Lower atmosphere, Meteorology, Atmospheric movements, Winds, Sea breeze, Temperature (atmospheric), Turbulence (atmospheric), Water.

Meteorology has more than a dozen recognized branches, and one of the newest is micrometeorology. This branch is concerned with the fine structure of atmospheric processes, particularly with what happens in the first few hundred feet above the earth's surface. It is in this shallow layer that much of the solar heat absorbed by the earth is trapped and the heat balance that sustains life on our planet is maintained. By detailed study of the physical processes involved, micrometeorology is providing an intimate knowledge of mechanisms controlling the weather. Of special importance to micrometeorology are the diurnal cycle of temperature change, laminar and turbulent fluid motion, and the slope winds and sea breezes that are caused by local temperature differences and related, respectively, to the presence of hills or bodies of water. The knowledge gained from studies of micrometeorological processes is being used to answer questions about phenomena such as the spread of smoke from industrial stacks and the evaporation of water from lakes and reservoirs. It has provided considerable enlightenment on the problems of atmospheric pollution. For instance, a formula is now available for calculating precisely how much pollution at ground level can be reduced by raising the height of a stack. Another important application of micrometeorology is its use in determining the amount of water required by plants. Such measurements have taken the guesswork out of irrigation.
APTIC-22275

### CHARACTERISTICS OF THE METEOROLOGICAL REGIME IN THE LOWER 300-M LAYER DETERMINED FROM TWO YEARS OF OBSERVATIONS ON A HIGH TOWER.

Tr. Inst. Priklad, Geofiz. (Leningrad), no. 10:3-17,
1967. 4 refs. Translated from Russian. L. Heenan,
Foreign Technology Div., Wright-Patterson AFB,
Ohio, Translation Div., 10p., Jan. 30, 1970. CFSTI,
DDC: AD 702976
G. B. Mashkova.
Identifiers: *Lower atmosphere, *Winds, *Micrometeorology, *Temperature (atmospheric), Ussr, Ground level, Wind rose, Pressure (atmospheric), Inversion, Lapse condition, Temperature gradient, Annual, Diurnal, Monthly, Seasonal.

Based on two-year observations from a high meteorological tower, average values are presented for diurnal, monthly, and seasonal variations of air temperature and wind speed in the 300-m layer. Data on the character of changes in wind direction are also included. The greatest variation in vertical temperatures are observed in the lower 100-m layer, particularly in the warm half of the year when high superadiabetic gradients are observed during the day and large inversion gradients at night. Wind speed in the ground layer at 8 m tends to be higher in the winter than in the summer. Wind profiles in all seasons are characterized by a rapid growth in speed with an altitude of 100-120 m and a slower growth above. Vertical gradients of wind speed vary with time of day, being greatst at night. They also change from season to season, increasing in winter and autumn and decreasing in the spring and summer. Throughout the year, the most frequent winds at 8 m are 1.1-5.0 m/s. Above 100 m, the frequency of winds greater than 5m/s increases significantly, while the frequency of winds from 1-5 m/s decreases. The most frequent winds throughout the 300-m layer are northwesterly or northerly; the least frequent are easterly. Total wind rotation in this layer during the day is 10-25 deg and during the night, 40-50 deg.
APTIC-22297

### VISIBILITY AND LIGHT SCATTER AS A MEASURE FOR AIR POLLUTION.

Staub (English translation from German of: Staub,
Reinhaltung Luft), 29 (12), 26-32, Dec. 1969. 18
refs. CFSTI: TT 69-55002/12
Helmuth Horvath.
Identifiers: *Visibility, *Light scattering, Aerosols, Mathematical analyses, Scattering (atmospheric).

Low atmospheric visibility is one of the most readily recognized consequences of air pollution. Whether a quantitative relationship exists between visibility and pollution concentration has been, until recently, an open question. A very simple formula relating visibility and a light extinction coefficient is derived. A series of measurements were performed under usually occurring conditions and the relationship thus found agreed well with theory. Since the atmospheric aerosol has an approximately constant size distribution, a linear relation between scattering coefficient and mass concentration was found. A combination of these two results yields a new relation: Visibility times Mass concentration equals constant. Therefore it is possible to use measurements of visibility and light scattering to deduce the mass concentration.
APTIC-22299

### THE ERRORS IN THE ANALYTICAL CALCULATION OF THE DISPERSION OF ATMOSPHERIC TRACE SUBSTANCES (A CRITICAL COMPARISON BETWEEN MEASURED AND CALCULATED SO2 CONCENTRATIONS).

For primary bibliographic entry see Field 04.
APTIC-22306

### THE INCREASE IN THE SO2-CONCENTRATION DURING LONG-TERM WEATHER SITUATIONS WITH POOR DIFFUSION.

Staub (English translation from German of: Staub,
Reinhaltung Luft), 29 (12):32-35, Dec. 1969. 11
refs. CFSTI: TT 69-55002/12
Joergen Kolar.
Identifiers: *Inversion, *Sulfur dioxide, Germany, Urban areas, Ground level, Diffusion.

During long term weather situations with poor atmospheric diffusion, the ground level-sulfur dioxide-concentration in cities can reach values which constitute a hazard for humans. The increase in SO2 immission in the case of stable weather conditions was investigated on the basis of measurements and of theoretical work. The concentration occurs according to an exponential law the exponent of which, being in good agreement with the theory, is 0.75 on the average. Measurements carried out in Munich, during the weather inversion in December 1962, yield an average exponent of 3 for the increase in SO2 immission on two subsequent days.
APTIC-22310

### COMPARISON OF CALCULATED AND MEASURED MAXIMUM GROUND-LEVEL SO2 CONCENTRATIONS AND THEIR DISTANCE DOWNWIND FROM STRONG EMISSION SOURCES (POWER PLANTS).

For primary bibliographic entry see Field 01.
APTIC-22313

### A STATISTICAL STUDY ON THE VISIBILITY FORECASTING (PART 2)-PREPARATION AND VERIFICATION OF THE MULTIPLE REGRESSION EQUATION FOR VISIBILITY FORECASTING.

Kishacho Kenkyu Jiho (J. Meteorol. Res.
(Tokyo)), 21 (1):9-17, Jan. 1969. 4 refs. Translated
from Japanese. Franklin Inst. Research Labs.,
Philadelphia, Pa., Science Info. Services, 22p.,
Dec. 3, 1969.
S. Nomoto, Y. Takigawa, K. Enoshima, and M.
Anzai.
Identifiers: *Multiple regression, *Visibility, Japan, Computers, Mathematical analyses, Statistical analyses, Air pollution forecasting.

Multiple regression equations for visibility forecasting were constructed by using the HITAC 5020 computor. In these equations, predictands are the averaged visibilities in the afternoon and the minimum visibilities after sunset, and predictors are 35 meteorological elements observed in the morning. Verification confirms that the forecasted visibilities by the multiple regression equations are close to the observed ones; for instance, a correlation coefficient is 0.637. The relation of multiple correlation coefficients to the number of predictors through six multiple regression equations indicates that accuracy of the method increases up to 3 or 5, then increases slowly with the number of predictors employed. A regression equation was prepared for each N (N equals 1,2,....,20) of selected predictors out of 35 predictors, then each accuracy of the the methods by 5, 10 and 20 predictors was verified; the most accurate method is the one by 10 predictors, then the 5 and 20 predictors follow. (Author abstract modified)
APTIC-22315

### THE HEIGHT VARIATION OF VERTICAL HEAT FLUX NEAR THE GROUND.

Quart. J. Roy. Meteorol. Soc. (London), 90
(385):260-265, July 1964. 8 refs. (Presented at the
International Symposium of the Radiation
Commission of the IAMAP, Vienna, Austria,
1961.)
W. P. Elliott.
Identifiers: *Vertical heat flux, *Ground level, Diurnal, Diffusion, Temperature (atmospheric), Light radiation.

Profiles of vertical heat flux are obtained by subtracting the component of temperature change due to long-wave radiation flux divergence from some observed temperature changes and integrating the resultant temperature change. The method of computing the radiative component is essentially one suggested by Funk (1961). The resultant fluxes of sensible heat show significant height variations near the ground at night but almost no variation near the ground in the day. At night the coefficient of eddy conductivity increases with height up to about 50 metres and subsequently decreases. In the daytime the concept of thermal diffusion does not appear to adequately describe the sensible heat flux. (Author abstract modified)
APTIC-22325

### MEASUREMENTS OF THE PARTICLE SIZE DISTRIBUTION OF THE ATMOSPHERIC AEROSOL: II. EXPERIMENTAL RESULTS AND DISCUSSION.

J. Atmospheric Sci., 22 (5):577-584, Sept. 1965. 11
refs.
Ralph E. Pasceri, and S. K. Friedlander.
Identifiers: *Aerosols, *Particle size, Urban areas.

Distribution data obtained by sampling the Baltimore aerosol with a cascade impactor are reported for the range between 0.4 and 20 micron radius. Data for the range between 70 angstroms and 0.1 micron in radius are obtained in two runs with the rotating disk sampler. Greater variations are observed in the lower end of the spectrum than

in the upper end. The theory of self-preserving size distributions is used with some success to correlate data obtained in this and other studies. The distributions obtained with the rotating disc and impactor can be combined to give an approximate curve for the entire distribution function. The curve is valid for the size range 0.3 to 10 micron. (Author abstract modified)
APTIC-22364

### SALT NUCLEI IN MARINE AIR AS A FUNCTION OF ALTITUDE AND WIND FORCE.

J. Meteorol., vol. 10:362-371, Oct. 1953. 19 refs.
A. H. Woodcock.
Identifiers: *Oceans, *Sea salts, Particulates, Particle size, Altitude, Lower atmosphere, Winds, Clouds.

In a study of sea-salt nuclei, salt particles were collected on glass slides exposed from aircraft flying over the seas near Hawaii, Australia, and Florida. The slides were analyzed for particle count and individual particle size; the size measurements were used to compute particle weight. Large differences occurred in the numbers and sizes of the salt particles with variations in altitude, position, and the time of sampling. Increases in the amount of airborne salt near cloud bases were related to increases in wind force at the sea surface. The greatest proportionate increase in particle number occurred at the large end of the weight range. The differences in nuclei number and size with increasing altitude in the lower atmosphere were similar in pattern in Hawaii, Australia, and Florida. It is suggested that bursting air bubbles in whitecaps on the open sea are a major source of the salt nuclei, and that a greater portion of the sea surface may act as a source of these particles during average winds than might be expected from the relatively small area usually covered by the whitecaps. (Author abstract modified)
APTIC-22366

### ATMOSPHERIC PHOTO-OXIDATION OF OLEFINS.

Arch. Environ. Health, vol. 7:188-201, Aug. 1963. 10 refs. (Presented at the Air Pollution Medical Research Conference on Motor Vehicle Exhaust Emissions and Their Effects, 5th, Los Angeles, Calif., Dec. 5-7, 1961.)
Charles S. Tuesday.
Identifiers: *Olefins, *Photooxidation, Spectrophotometry, Butenes, Nitric oxide (no), Nitrogen dioxide (no2), Reaction mechanisms.

Effects of various concentrations of nitrogen dioxide and nitric oxide on the photooxidation rates of propylene, isobutene, trans-2-butene, and 2,3-dimethyl-2-butene were determined together with the effects of nitrogen oxide concentration on reaction products. Light intensity was measured in terms of the rate of nitrogen dioxide photolysis in nitrogen with an infrared spectrophotometer. Initial increases in NO2 concentration increased the photooxidation rate of all the olefins studied, but when the initial NO2 concentration was increased further, however, each olefin behaved differently. The photooxidation rate of tetramethylethylene increased slightly with increased NO2 concentration even at the highest concentration used, whereas the rate increased slightly for trans-2-butene at intermediate concentrations of NO2 and then decreased at the highest concentration. The rate of isobutene photooxidation decreased slightly at NO2 concentrations greater than one half the initial olefin concentration, and NO2 concentrations higher than this also decreased the rate of propylene photooxidation markedly. A reaction scheme is proposed for the trans-2-butene-nitric oxide system. Nitric oxide promotes or inhibits olefin photooxidation depending upon the ratio of reactants, whereas nitrogen dioxide promotes or inhibits olefin photooxidation depending both on the relative concentration of reactants and the nature of the olefin.
APTIC-22376

### WEAK THERMAL VORTEX RINGS.

J. Fluid Mech. (Cambridge), vol. 9: 107-118, 1960. 4 refs.
B. R. Morton.
Identifiers: *Thermal vortex rings, *Plume behavior, Great britain, Stacks, Mathematical analyses, Diffusion models, Point sources, Heat transfer.

A similarity solution is obtained up to the first order in an effective Rayleigh number for the behavior of very weak thermal vortex rings produced by the rapid release of heat at one point of a large region of fluid, for instance, an industrial stack emitting a large volume of gaseous effluent. The laminar pattern of flow is similar to that in ordinary vortex rings, but the temperature decreases outwards from the center in all directions with some asymmetry about the horizontal plane through the center, and there is no accumulation of heat into the vortex ring. The vortex propagates slowly in relation to its rate of growth, and the process is dominated by viscous and thermal diffusion. (Author abstract modified)
APTIC-22393

### A STATISITICAL STUDY ON VISIBILITY FORECASTING (PART I).

Kenkyu Jiho (J. Meteorol. Res.), 20 (12):1-16, Dec. 1963. 7 refs. Translated from Japanese. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 50p., Dec. 19, 1969.
S. Nomoto, and K. Enoshima.
Identifiers: *Visibility, *Statistical analyses, *Weather forecasting, Japan, Aerosols, Dust fall, Air pollution forecasting, Lower atmosphere, Winds, Clouds, Humidity, Precipitation, Pressure (atmoshperic), Temperature (atmospheric), Inversion.

A method for objective forecasting of visibility by means of statistics and correlative analysis is described. Visibility predictors and correlative coefficients are calculated for minimum visibility in the evening and averaged for days with or without rainfall. Useful predictors with high correlation coefficients, such as meso-scale pressure pattern, atmospheric stability, and wind velocity in the lower atmosphere are selected. By combining these, some forecasting diagrams are constructed. The forecasting method by these diagrams is verified as useful; minimum visibility in the morning and evening can, in general, be predicted within an error of 1.5 miles. The method considers industrial pollution in the form of volume and variation of aerosols. Other parameters considered include cloud cover, dust-fall, precipitation, temperature, pressure, humidity, winds, and inversions. (Author abstract modified)
APTIC-22403

### METEOROLOGICAL PROBLEMS OF ASSURING ATMOSPHERIC PURITY.

(Meteorologicheskiye problem obespecheniya chistoty atmosphery). Text in Russian. Meteorol. i Gidrol., no. 11:50-62, 1967. 11 refs.
M. Ye. Berlyand.
Identifiers: *Diffusion, *Plume behavior, Ussr, Industrial areas, Stack gases, Dusts, Mathematical modeling, Ground level, Lower atmosphere, Atmospheric movements, Winds, Scattering (atmospheric), Topographic interactions.

Work carried out at the Main Geophysical Observatory within recent years, and related to the growing need for large-scale understanding of atmospheric interactions in connection with the increasing problem of air pollution, is reviewed. Semiempirical formulas are given for atmospheric diffusion as a function of source height; effective emission height as a function of velocity and temperature of the exhaust gas; and maximum combined impurity concentration for multiple sources. Maps showing areas of intense industrial air pollution and levels of near-ground dust content of the air are presented. The following relationships are plotted graphically; impurity concentration and distance of maximum concentration from a source as a function of the ratio of actual wind velocity to critical (hazardous) wind velocity, and the change in impurity concentration with distance from source (up to 15 km) for various atmospheric stratifications and various vertical wind velocity profiles. The preliminary nature of this work is stressed.
APTIC-22469

### THE ROLE OF ATMOSPHERIC PRECIPITATION IN THE CIRCULATION OF CHEMICAL ELEMENTS BETWEEN THE ATMOSPHERE AND THE LITHOSPHERE.

(Rol' atmosfernykh osadkov v krugovorote khimicheskikh elementov mezhdu atmosferoy i litosferoy). Text in Russian. Doklady Akad. Nauk SSSR, 181 (3):716-719, 1968. 17 refs.
V. P. Zverev.
Identifiers: *Precipitation, *Mineralization, Deposition, Ussr, Industrial areas, Mountains, Micrometeorology, Topographic interactions, Ammonium compounds, Chlorine compounds, Calcium compounds, Magnesium compounds, Sodium compounds, Nitrates, Nitrogen trioxide (no3), Sulfates, Ions, Ph.

A study based on more than 1500 precipitation samples taken at 115 points throughout the Soviet Union revealed a regular increase in mineralization on going from regions of excess or sufficent precipitation into drier zones. This change is also accompanied by an increase in pH of atmospheric precipitation and an increase in content of the following ions: Na (+), Ca (2+), Mg (2+), Cl (-), SO4 (2-), and HCO3 (-) (data are tabulated). The content of nitrogen compounds (HN4 (+), NO3 (-)) was nearly constant in all climatic regions except near industrial centers. Mineralization of atmospheric precipitation was lower in mountainous areas than in the general climatic zone surrounding them. Deposition of dissolved substances ranged from 6.1 (excess precipitation) to 26.4 (dry climate) tons/sq km-yr with an average of 12 tons/sq km-yr and a total deposition of 258 million tons per year for the entire territory of the Soviet Union.
APTIC-22471

### THE COAGULATION OF CHARGED CLOUD-DROPLETS.

Doklady Akad. Nauk SSSR, 94 (3):467-470, 1954. 7 refs. Translated from Russian. Fort Detrick, Frederick, Md., 5p., March 1958. CFSTI, DDC: AD 682867
L. M. Levin.
Identifiers: *Droplets, *Clouds, *Particle growth, *Electric charge, Ussr, Particle size, Mathematical analyses, Precipitation.

The current theory of the formation of precipitation postulates that the growth of cloud droplets 4-30 micron in diameter takes place by way of condensation of water vapor. Coagulation of two neutral drops is assumed to occur only when the diameter of the larger drop exceeds 30 micron. In the present work, the coefficient of capture of electrically charged droplets was calculated to test the hypothesis that the growth of cloud droplets 3-40 micron in diameter may take place through coagulation. The coefficients appear high enough to guarantee a considerable coagulation of particles. For neutral droplets of the same size, there appears to be no coagulation. It is further shown that in cloud-droplet catchers, the precipitation of droplets onto the receiver is in practice independent of the electric charge of the droplets and of the droplet receiver.
APTIC-22565

### DUST DEPOSITION FROM CHIMNEY STACKS.

Inst. of Mechanical Engineers, London (England), Proc. Inst. Mech. Engrs. (London), vol. 162:355-367, 1950. 5 refs.
C. H. Bosanquet, W. F. Carey, and E. M. Halton.
Identifiers: *Diffusion, *Deposition, *Dusts, *Stacks, Great britain, Stack gases, Centrifugal

separators, Design criteria, Mathematical analyses, Ground level, Plume behavior, Winds.

Economic competition compels many firms to operate processes which emit gases carrying a dust burden many thousand times that of atmospheric air. Even after treatment in the most expensive deduster this effluent will still hold some 5 per cent of its original dust, so that it must be discharged up a tall chimney. Wind eddies then dilute the chimney gases until they can be tolerated at ground level; however, during dilution, the coarser dust is liable to settle and cause objectional deposits in the vicinity. The problem of designing an installation to avoid nuisance is therefore to remove the coarser grits in a deduster and to arrange the stack to dilute the finer residue so that deposits will not be noticed. A set of reasonably simple formulae and charts for predicting the path of particles emitted from a stack and spread by the wind are developed. Experimental checks have been applied to the predictions, but the subject is complex, and at this stage it is unlikely that it will be possible to predict the rate of deposit within a factor of 2. A worked example is given on a powdered-coal boiler installation. With properly designed cyclones and a moderately high stack, there will be no noticeable deposits. The implication is that it should be possible in time to extend the treatment given to specify a deduster exit which will avoid nuisance with fair certainty and at a relatively moderate cost. (Author abstract modified)
APTIC-22584

### PHORETIC AND BROWNIAN DIFFUSION PROCESSES IN THE BELOW-CLOUD SCAVENGING OF AEROSOL PARTICLES BY RAIN.

In: Pacific Northwest Laboratory Annual Report for 1969 to the USAEC Division of Biology and Medicine. Volume II: Physical Sciences. Part I. Atmospheric Sciences. Battelle Northwest, Richland, Wash., Environmental and Life Sciences Div., p. 70-76, June 1970. 13 refs. CFSTI: BNWL-1307, Part 1
W. G. N. Slinn, and J. M. Hales.
Identifiers: *Aerosols, *Diffusion, *Rain, Particle size, Clouds, Washout, Brownian movement.

An analysis is made of the relative importance of thermophoresis, Brownian diffusion, and diffusiophoresis in the below-cloud rain scavenging of aerosol particles. For particles of radii less than about 0.01 micron, Brownian diffusion is most important. For particles of radii between 0.01 and 1.0 micron, thermophoresis can be dominant. A graph of the resultant washout coefficient is presented which includes an estimate of the enhancement of the scavenging by thermophoretic effects. (Author abstract modified)
APTIC-22588

### THE LAKE-BREEZE AT DOUGLAS POINT, ONTARIO.

Michigan Univ., Ann Arbor, Great Lakes Research Div., Proc. Conf. Great Lakes Res. 10th, 1967, p. 231-239. 5 refs.
R. E. Munn, and T. L. Richards.
Identifiers: *Lakes, *Winds, *Temperature gradient, Canada, Lower atmosphere, Dispersion, Diffusion, Temperature (atmospheric), Inversion, Lapse condition, Topographic interactions.

The vertical profiles of temperature and wind on days favorable for study were analyzed for supporting data in an atmospheric diffusion program at Douglas Point on Lake Huron. A slight inversion occurs over the water, intensified by Lake breezes. Consequently, its base rises to a height of 100-400 feet, while three miles inland, where the land is cleared for farming, daytime inversions are rare at altitudes of less than 900 feet, although they occur occasionally just above the top of the internal boundary layer and only when there are moderately strong winds and a large land-lake temperature contrast. The data is tabulated according to the time of day and the geostrophic wind direction, which can be off-land, off-water, or parallel to the shore. Temperature profiles are consistent in their pattern, while vertical wind profiles vary greatly from day to day, even for similar geostrophic wind conditions.
APTIC-22596

### METEOROLOGICAL ASPECTS OF DENVER AIR POLLUTION.

Colorado State Univ., Fort Collins, Colo., Dept. of Atmospheric Science, Grant AP 00216, P-158, 41p., April 1970. 10 refs.
Herbert Riehl, and Dirk Herkhof.
Identifiers: *Meteorology, *Area surveys, *Denver, Colorado, Urban areas, Air pollution forecasting, Ground level, Line sources, Transport, Convection (atmospheric), Winds, Haze, Micrometeorology, Temperature (atmospheric), Topographic interactions, Turbulence (atmospheric).

During the winters of 1964-1965 and 1965-66 a large network of stations measuring wind, temperature and coefficient of haze was maintained in the Denver metropolitan area with the objective of determining the meteorological factors relevant to air pollution episodes in Denver. Pollution is removed in part by what is called the friction-stovepipe effect, a net indraft of air into the city which rises there and then moves outward again; in part by ventilation from winds blowing across town horizontally; and to a smaller extent by vertical turbulence in the middle of the day. The distribution of pollution sources and of sedimentation is computed with some assumptions. Although the source of pollution is strongest in the center of the city day and night, the outer parts of the metropolitan area also contribute substantially. Strongest pollution concentration remains over and north of the city center. The transport processes carry pollution away but, analogous to a heat source, the highest pollution level remains in the general area of the principal source. The daily course of pollution exhibits two daily maxima and minima as in many cities; the explanation turns out to be rather complex partly dependent on local factors and cannot simply be related to the two waves of commuter traffic. Pollution does not increase or decrease as a uniform blanket over the city during pollution episodes. Rather, it is common for the polluted mass to be concentrated in one part of town while others are relatively clear. The circumstances governing the location of such concentration are explored and an attempt is made to develop a forecasting method, at least partly. The onset and recession of periods with extreme pollution, as well as the termination of pollution episodes, is analyzed with view to developing transport criteria related to these events. Extreme peaks last only a short time, 2 - 4 hours, while onset and recession may take 8 - 10 hours each, so that an extreme event comprises a time span somewhat less than a day in the mean. Conclusions and recommendations are presented for operational and for planning purposes. (Author abstract modified)
APTIC-22613

### WEATHER AND AIR POLLUTION.

American Inst. of Medical Climatology, Philadelphia, Pa., Proc. Symp. Air Pollution Health, Philadelphia, Pa., 1966, p. 12-17. (April 21.)
Francis K. Davis Jr.
Identifiers: *Diffusion, *Atmospheric movements, *Stability (atmospheric), Ground level, Winds, Wind rose, Micrometeorology, Temperature (atmospheric), Inversion, Lapse condition, Temperature gradient, Turbulence (atmospheric).

The weather elements of primary concern in air pollution problems are wind direction, wind speed, change of wind with height, and change of temperature with height. The ability of the atmosphere to dilute contaminants appears to depend mainly on the wind direction and velocity and on the stability of the air. It is theorized that there is an inverse relationship between wind speed and contamination at ground level; the higher the wind speed, the greater the intensity of turbulent diffusion, and the lower the concentration of contaminants at the ground. The stability of air can be characterized by its lapse rate. The average lapse rate in the atmosphere is 0.65 C/100 m or 3.5 F/1000 ft. If the temperature is constant, the lapse rate is said to be isothermal; if the lapse rate is inverted, that is, the temperature increases with height, it is referred to as a temperature inversion which reflects poor atmospheric diffusion. Theoretically, the relationship between stability and pollutant concentration is direct; the higher the degree of stability, the greater the concentration at the ground. The persistance of an inversion may result in high pollutant concentrations at ground levels for extended periods, leading to poor visibility and eye irritation.
APTIC-22614

### PROBLEMS OF ATMOSPHERIC SHEAR FLOWS AND THEIR LABORATORY SIMULATION.

Advisory Group for Aerospace Research and Development, Paris (France), Aerodyn.
Atmospheric Shear Flow, Proc. Conf., Munich, Germany, 1969, no. 48:12-1 to 12-16. 68 refs. (Sept. 15-17.) CFSTI, DDC: AD 702659
J. E. Cermak, and S. P. S. Arya.
Identifiers: *Simulation, *Atmospheric movements, Testing facilities, Winds, Topographic interactions, Turbulence (atmospheric).

Flow of the atmosphere over the earth's surface is affected by factors which are not included in the treatment of classical two-dimensional turbulent boundary layers. Major effects are produced on the low-speed flows by thermal stratifaction, large surface roughness, nonuniformity of surface roughness and temperature, topographical features, and rotation of the earth. Except for the effects of rotation, the influence of these factors has been studied successfully in the laboratory. Comparison of data taken from the atmosphere and from the laboratory in the 'constant-stress layer' shows that similarity of these flows can be attained. This simulation capacity should be further developed for the purpose of studying the basic nature of these complex flows, which have not been amenable to theoretical treatment, and to provide improved modeling techniques. As revealed by past experience, simulated atmospheric shear flows are important in the study of problems associated with air pollution, structural aerodynamics, and modification of local environments. Wind tunnels which satisfy the similarity criteria between atmospheric shear flows and simulated flows are described. Of the tunnels, those that show promise for extending fundamental studies of stratified flows use vortex generators in conjunction with a grid of plates to obtain thick turbulent boundary layers. (Author summary modified)
APTIC-22678

### A REVIEW OF INDUSTRIAL PROBLEMS RELATED TO ATMOSPHERIC SHEAR FLOWS.

Advisory Group for Aerospace Research and Development, Paris (France), Aerodyn.
Atmospheric Shear Flow, Proc. Conf., Munich, Germany, 1969, no. 48:23-1 to 23-18. 19 refs. (Sept. 15-17.) CFSTI, DDC: AD 702659
C. Scruton.
Identifiers: *Winds, *Topographic interactions, *Aerodynamics, Great britain, Buildings, Mathematical analyses, Simulation, Testing facilities, Dispersion, Plume behavior, Turbulence (atmospheric).

The nonaeronautical problems related to atmospheric shear flows are broadly divided into those of the effects of the airflow itself on environmental conditions and those of the effects of the airflow on structures immersed in it. The first category includes wind shelter, smoke dispersal,

and the flow of wind in and around building complexes. With respect to the dispersal of pollutants, the local airflow will dominate the dispersal of a plume the source of which is close to buildings, or in a valley, or close to an escarpment. To provide estimates of resulting local pollution, recourse must be made to wind-tunnel experiments which reproduce geometric similarity, similarity of the wind shear and turbulence of the approach stream, and equivalence of certain similarity parameters concerning plume bouyancy and efflux effect. An analytical method is presented for determining gas concentrations from plumes emitted by a stack surrounded by flat open ground. The most important problem in the second category of shear flow effects is related to the design of structures against the loadings due to wind. For many buildings, consideration of the time-averaged wind loads is sufficient. However, the new taller and lighter structures are prone to respond to the unsteady wind loading which arises from fluctuations of wind force or the inherent aerodynamic instability of the structures. In the above problems, the important properties of atmospheric winds are the variation of speed and direction with height and the turbulence characteristics, which are dependent on height. These properties vary with the terrain over which the wind flows and with the strength of the wind. (Author summary modified)
APTIC-22679

### MESOSCALE STUDIES AT HANFORD.

In: Pacific Northwest Laboratory Annual Report
for 1969 to the USAEC Division of Biology and
Medicine. Volume II: Physical Sciences. Part 1.
Atmospheric Sciences. Battelle Northwest,
Richland, Wash., Environmental and Life
Sciences Div., p. 29-34, June 1970. CFSTI: BNWL
-1307, Part 1
H. G. Daubek, and M. A. Wolf.
Identifiers: *Winds, Meteorological instruments.

Wind velocity summaries at several sites on the Hanford reservation, streamline analysis, and the tracking of tetroons and pibals were used to identify mesoscale air flow in the area. Comparison of the data obtained indicates that the mesoscale flow at Hanford is too complex to permit use of data from a single instrumented site for the definition of pollutant trajectory and diffusion. The several techniques that were used and the projected employment of and instrumented aircraft can contribute significantly to the identification and understanding of mesoscale anomalies. Such understanding will lead ultimately to improved predictability of mesoscale meteorology.
APTIC-22680

### TURBULENT GRAVITATIONAL CONVECTION FROM MAINTAINED AND INSTANTANEOUS SOURCES.

Proc. Roy. Soc. (London), Ser. A, vol. 234:1-23,
Jan. 24, 1956. 11 refs.
B. R. Morton, Geoffrey Taylor, and J. S. Turner.
Identifiers: *Plume behavior, *Convection (atmospheric) turbulence (atmospheric), Great britain, Stack gases, Stacks, Height finding, Convection (atmospheric), Turbulence (atmospheric), Fluid flow, Flow rates.

Theories of convection from maintained and instantaneous sources of buoyancy are developed, using methods which are applicable to stratified body fluids with any variation of density with height; detailed solutions are presented for the case of a stably stratified fluid with a linear density gradient. The three main assumptions involved are (1) that the profiles of vertical velocity and buoyancy are similar at all heights, (2) that the rate of entrainment of fluid at any height is proportional to a characteristic velocity at that height, and (3) that the fluids are incompressible and do not change volume on mixing, and that local variations in density throughout the motion are small compared to some reference density. The governing equations are derived in non-dimensional form from the conditions of conservation of volume, momentum and buoyancy, and a numerical solution is obtained for the case of the maintained source. This leads to a prediction of the final height to which a plume of light fluid will rise in a stably stratified fluid. Estimates of the constant governing the rate of entrainment are made by comparing the theory with some previous results in uniform fluids, and with the results of new experiments carried out in a stratified salt solution. For the case of an instantaneous source of buoyancy there is an exact solution; the entrainment constant is again estimated from laboratory results for a stratified fluid. The analysis is applied to the (compressible) atmosphere, by making the customary substitution of potential temperature for temperature. Predictions are made of the height to which smoke plumes from typical sources of heat should rise in a still, stably stratified atmosphere under various conditions. (Author abstract modified)
APTIC-22701

### THE WAVELENGTH DEPENDENCE OF THE SCATTERING OF LIGHT IN THE ATMOSPHERE.

Doklady Akad. Nauk SSSR, 80 (4):595-598, 1951. 1
ref. Translated from Russian by C. R. Haave,
Johns Hopkins Univ., Silver Spring, Md., Applied
Physics Lab., 7p., Nov. 9, 1967.
E. V. Pyaskovskaya-Fesenkova.
Identifiers: *Solar radiation, *Light scattering, Seasonal, Ussr, Dusts, Particle size, Humidity.

Measurements of light scattering for various wavelengths of solar radiation are described. Scattering equations are derived and discussed. Measurement equipment includes a corona photometer and a visual photometer. Measurement curves are presented for winter days with snow cover and for autumn days with varying degrees of dust content. Humidity is an important factor in winter scattering. is a sum whose terms depend on scattering particles of different radii, from molecules to comparatively large dust particles.
APTIC-22706

### INVESTIGATIONS IN THE PHYSICS OF COARSE-DISPERSED AEROSOLS.

(Issledovania po fizike grubodispersnykh
aerozoley). Moscow, Akademiya Nauk SSSR,
1961, 267p. 132 refs. Translated from Russian.
Foreign Technology Div., Wright-Patterson AFB,
Ohio, Translation Div., 216p., May 9, 1968.
CFSTI, DDC: AD 682821
L. M. Levin.
Identifiers: *Clouds, *Precipitation, *Aerosols, Ussr, Droplets, Particle size, Particulate sampling, Electrostatic precipitators, Gravity settling, Mathematical modeling, Dispersion, Aerodynamics, Flow rates, Particle growth, Electric charge.

A new division of atmospheric physics, the physics of clouds and precipitation, is discussed. Investigations of the processes of inertial and electrostatic settling of coarse-dispersed aerosol particles onto various obstacles from a stream are described. Theory is developed as it applies to microphysical properties in clouds, but the results obtained can be used in investigation of processes in other coarse-dispersed aerosols. A mathematical analysis of the aerodynamics of particle sampling is presented. A size distribution function of cloud droplets is derived. Coagulation of charged aerosol particles is discussed. (Author abstract modified)
APTIC-22710

### OLYMPIC PENINSULA RAIN: CHARACTERIZATION OF SIZE AND ELECTRIC CHARGE.

IN: Pacific Northwest Laboratory Annual Report
for 1969 to the USAEC Division of Biology and
Medicine. Volume II: Physical Sciences. Part 1.
Atmospheric Sciences. Battelle Northwest,
Richland, Wash., Environmental and Life
Sciences Div., p. 86-91, June 1970. 7 refs. CFSTI:
BNWL-1307, Part 1
M. T. Dana.
Identifiers: *Rain, *Electric charge, *Particle size, Droplets, Winds, Clouds.

A number of raindrop charge and size distributions, computed from data collected at a research site on the Olympic Peninsula, are grouped, and their median values characterized, in terms of rainfall intensity. The median diameter increases at approximately the one-sixth power of rainfall intensity J, while the median charges increase at powers of J from one-half to one. Comparisons of gross size and charge spectra indicate a dependence of the charge upon raindrop area, in agreement with the theoretical proposals of Gunn and Sartor. The rainfall intensity dependency apparently is complicated by a number of meteorological variables, such as wind, thickness of cloud layer, and droplet size distribution. (Author abstract modified)
APTIC-22711

### DIFFUSION OF ATMOSPHERIC GASES TO AND FROM THE SOIL.

Preprint, Georgia Inst. of Tech., Atlanta, School
of Chemical Engineering, 20p., 1956 (*). 4 refs.
J. M. DallaValle.
Identifiers: *Soils, *Diffusion, *Gases, Ground level, Winds, Pressure (atmospheric), Turbulence (atmospheric).

Methods for analyzing the exchange of soil and atmospheric gases are outlined. The three major diffusional processes associated with the exchange are variation of atmospheric pressure, Fick diffusion, and turbulent diffusion due to surface winds. The effect of barometric change is very small in comparison with Fick diffusion and atmospheric turbulence. Quantitative estimates of the magnitude of the various diffusional processes are made, and the effect of atmospheric pollutants stored in the soil and released are shown to be calculable. (Author abstract modified)
APTIC-22712

### THE ROLE OF ANISOTROPIC BROWNIAN DIFFUSION IN THE PRECIPITATION SCAVENGING OF SUBMICRON PARTICLES.

IN: Pacific Northwest Laboratory Annual Report
for 1969 to the USAEC Division of Biology and
Medicine. Volume II: Physical Sciences. Part 1.
Atmospheric Sciences. Battelle Northwest,
Richland, Wash., Environmental and Life
Sciences Div., p. 82-86, June 1970. 7 refs. CFSTI:
BNWL-1307, Part 1
W. G. N. Slinn.
Identifiers: *Particulates, *Diffusion, *Precipitation, Particle size, Convection (atmospheric), Clouds, Brownian movement, Fluid flow.

The concept of anisotropic Brownian diffusion is discussed within the context of precipitation scavenging of submicron particles. The analysis starts from a generalized, convective diffusion equation which contains the influence on the motion of Brownian particles of nonuniformities in the host gas. These effects include tensor diffusivity and 'stressphoresis.' A boundary layer approximation to the new equation reveals that the corrections to the use of Einstein's diffusion coefficient are insignificant for below-cloud scavenging. The new effects could be important in flows with large Mach or Knudsen numbers. (Author abstract modified)
APTIC-22713

### EFFECT OF FOG ON RADIOACTIVE CONTAMINATION IN THE BIOSPHERE.

(Der Einfluss des Nebels auf die radioaktive
Kontamination in der Bioshpere). Text in German.
Z. Meteorol., 20 (1-6):37-42, 1968. 13 refs.
(Presented at the East German Meteorological
Society 'Technical Meteorology' sessions, Sept.
22-24, 1966.)
W. Marquardt:
Identifiers: *Fog, *Radioactive radiation, Germany, Ground level, Winds, Condensation (at-

mospheric), Precipitation, Rain, Topographic interactions.

Experimental data indicate that meteorological factors have a strong effect on radioactive contamination of the biosphere. Fog has an especially strong influence. Fog can decrease air movement by a factor of 2 or 3 in hilly country. The water content of the fog is especially radioactive, often possessing 10-15 times the intensity of radiation found in normal rainwater. Every fog droplet is loaded with a high content of air pollutants. Radioactive aerosols can serve as centers of condensation. Whenever the fog encounters some obstacle, even a blade of grass, the droplets precipitate, bringing about a partial decontamination of the atmosphere. Studies of water derived from fog show that this effect is most pronounced when the fog first forms; thereafter, the rate decreases as a logarithmic function. The 'cleansing' effect increases as a function of wind velocity. The effect is more pronounced at Brocken, a peak in the Harz mountains (altitude 1135 m) than at Inselsberg (920 m). Concentrations of pollutants at the former site are 39% and at the latter site 46% of concentrations recorded in the lowlands, where fog seldom occurs simultaneously with high winds.
APTIC-22715

### TURBULENT DIFFUSION IN THE ATMOSPHERE.

World Meteorological Organization, Geneva
(Switzerland), Commission for Aerology, TN-24,
WMO-77.TP.31, 68p., 1958. 178 refs.
C. H. B. Priestley, R. A. McCormick, and F.
Pasquill.
Identifiers: *Diffusion, *Turbulence (atmospheric), Area surveys, Air pollution episodes, Europe, Industrial emission sources, Stacks, Mathematical modeling, Air pollution forecasting, Ground level, Lower atmosphere, Dispersion, Diffusion models, Plume behavior, Fumigation, Looping, Point sources, Transport, Meteorology, Atmospheric movements, Anticyclones, Winds, Condensation (atmospheric), Humidity, Inversion, Stagnation.

Theoretical results on turbulent diffusion, current research on the diffusion of water vapor into the lower atmosphere, and air pollution in industrial areas are reviewed. Transfer theories are critically analyzed, discussion is presented pertaining to the diffusion of matter in the absence of a definable transfer of momentum, and some applications of the various theories are considered. A similar treatment is afforded diffusion of water vapor; emphasis is placed on specific humidity as a function of space, time, and vertical gradient. Eddy diffusivity is treated both from the standpoint of diffusion and turbulence. Consideration is given to the phenomena of evaporation and dew (condensation) as they relate to the topic of diffusivity. Air pollution is treated in its meteorological context: diffusion and/or dispersion of pollutants by the free movement of air, excluding consideration of the behavior of particulate matter. This restriction imposes a size-range limitation to that of true atmospheric aerosols (0.5-10 micron) and excludes such effects as electrostatic, thermal, or photochemical processes or washout by precipitation. The rate of pollutant production is independent of the prevailing meteorological conditions. The problem is defined as three stage: emission into the atmosphere; transfer through the atmosphere; and deleterious contact with people, livestock, vegetation, and material. While emphasis is placed on the transfer stage, plume behavior, effective stack height; multiple source emission areas are treated insofar as they affect the transfer mechanism. The insidious problems of fumigation and looping are discussed as are the more dramatic problems of atmospheric stagnation and inversion. The effect of the transformation of polar anticyclones into warm-type anticyclones on atmospheric stagnation is discussed. The use of mathematical models in the prediction of air pollution episodes is mentioned as is the importance of meteorological considerations both in the formulation of the models and in the formulation of air pollution area survey programs. Recommendations for future investigations in the areas of atmospheric turbulence, diffusion, and air pollution are presented.
APTIC-22717

### ATMOSPHERIC AEROSOLS BETWEEN 700 AND 3000 M ABOVE SEA LEVEL. PART III. A STUDY OF THE EFFECTS OF ATMOSPHERIC FINE STRUCTURE CHARACTERISTICS ON THE VERTICAL DISTRIBUTION OF AEROSOLS. (FINAL TECHNICAL REPORT).

Fraunhofer-Gesellschaft, Garmisch-Partenkirchen
(West Germany), Physikalisich-Bioklimatische
Forschungsstelle, Army Contract DAJA 37 68 C-
0331, 100p., Jan. 1969. 6 refs.
Reinhold Reiter.
Identifiers: *Aerosols, *Lower atmosphere, *Transport, Seasonal, Germany, Statistical analyses, Winds, Clouds, Humidity, Temperature (atmospheric), Stability (atmospheric), Inversion, Lapse condition, Temperature gradient.

A study of the effects of fine-structure characteristics of temperature and humidity at levels up to 3000 m on the aerosol vertical transport process is reported. The results of observational data are evaluated with a view to obtaining generalized rules, by inference, from conditions observed in specific situations. Two methods were used to acquire the data: determination of the mean vertical-mass-exchange coefficient between 700 and 1800 m and 1800 and 3000 m from measurements of the radon B concentrations at these three levels, and determination of incremental vertical-mass-exchange coefficients of small, vertically adjoining layers (usually 100 m thick) from 700 to 1800 m by aerological soundings of particle concentration in the air by measuring its electrical conductivity. Measurements made at the three fixed sites were combined with the continuous soundings made between two levels. The mean and incremental vertical-mass-exchange coefficients were studied in their relation to mean and incremental temperature lapse rates, stability energy of selected layers, and other pertinent meteorological parameters. The following relationships were derived, the degree of statistical significance established, and the relationship concerned defined in numerical terms by construction of regression lines: 1) mean vertical-mass-exchange coefficient as a function of the mean temperature lapse rate; 2) mean vertical-mass-exchange coefficient as a function of stability energy and the effects of wind direction and air-mass characteristics on this relationship; 3) incremental vertical-mass-exchange coefficient in 100 m increments as a function of the maximum local lapse rate in inversions; 4) minimum incremental vertical-mass-exchange coefficient as a function of the stability energy; 5) the relationship between the mean vertical-mass-exchange coefficient and the lowest incremental exchange coefficient; and 6) variations of incremental mass-exchange coefficients and incremental temperature lapse rates above, in, and below inversions of different types, as shown statistically with reference to the effects of cloudiness, humidity, and the seasonal cycle.
APTIC-22719

### ADVANCES IN THE MECHANICS OF AEROSOLS.

For primary bibliographic entry see Field 06.
APTIC-22721

### CONCENTRATION FLUCTUATIONS IN DIFFUSING PLUMES.

IN: Pacific Northwest Laboratory Annual Report
for 1969 to the USAEC Division of Biology and
Medicine. Volume II: Physical Sciences. Part 1.
Atmospheric Sciences. Battelle Northwest,
Richland, Wash., Environmental and Life
Sciences Div., p. 27-29, June 1970. 3 refs. CFSTI:
BNWL-1307, Part 1
J. V. Ramsdell.
Identifiers: *Diffusion, *Plume behavior, Statistical analyses, Winds.

Concentration fluctuations in diffusing plumes are examined through cumulative frequency distributions of short-term concentration measurements and the intensity of the concentration fluctuations. Concentration intermittency and the intensity of fluctuations are larger than expected. Both cumulative frequency distributions and the intensity of fluctuations are a function of crosswind position in the mean plume. (Author abstract)
APTIC-22726

### THE USE OF WIND TUNNELS IN INDUSTRIAL AERODYNAMIC RESEARCH.

Advisory Group for Aeronautical Research and
Development, Paris (France), Rept. 309, 49p., Oct.
1960. 31 refs. (Presented at the AGARD Fluid
Dynamics Panel Technical Meeting, Istanbul,
Turkey, Oct. 1960.) CFSTI: PB-188339
C. Scruton.
Identifiers: *Plume behavior, *Aerodynamics, *Wind tunnels, Buildings, Stacks, Vehicles, Testing facilities, Winds, Topographic interactions, Fluid flow.

The use of wind tunnels for the investigation of non-aeronautical problems is reviewed. The three main categories considered are flow problems; the assessment of the steady wind forces and pressures on vehicles, buildings, and structures; and the oscillatory effects of wind on structures. The experimental techniques used are very similar to those developed and used for aeronautical research. The location of stacks in relation to nearby buildings, and local topography and the consequent effect on plume behavior is studied. (Author summary modified)
APTIC-22727

### MODELING PEAK-TO-MEAN CONCENTRATION RATIOS IN DIFFUSING PLUMES.

IN: Pacific Northwest Laboratory Annual Report
for 1969 to the USAEC Division of Biology and
Medicine. Volume II: Physical Sciences. Part 1.
Atmospheric Sciences. Battelle Northwest,
Richland, Wash., Environmental and Life
Sciences Div., p. 21-15, June 1970. 2 refs. CFSTI:
BNWL-1307, Part 1
J. V. Ramsdell.
Identifiers: *Mathematical modeling, *Plume behavior, Diffusion, Winds.

A mathematical model for estimating peak-to-mean concentration ratios in diffusing plumes is developed using linear least squares regression techniques. The concentration ratios are presented as a function of normalized crosswind position and of the time ratio. The present model is not entirely satisfactory, as it exceeds certain values near the edge of the mean plume. Continued attempts to rectify the deficiencies of the model and to provide a quantitative evaluation of the model are being made. (Author abstract modified)
APTIC-22728

### OZONE OBSERVATIONS AND THEIR METEOROLOGICAL APPLICATIONS.

World Meteorological Organization, Geneva,
Switzerland, TN-36, WMO-108.TP.46, 48p., 1961.
70 refs.
H. Taba.
Identifiers: *Meteorology, *Ozone, Seasonal, Europe, Air quality measurements, Lower atmosphere, Middle atmosphere, Transport, Pressure (atmospheric), Ultraviolet radiation.

General guidance on instrumental and observational problems in ozone is provided. Different possible mechanisms of ozone production are mentioned. Ultra-violet rays of the sun are the most effective ozone-producing agent in the atmosphere. A comprehensive review of ozone observations of all types is included. In the northern hemisphere, there is a maximum of ozone in the

spring and a minimum in autumn. Ozone concentration reaches a maximum at about 25 km and then falls to samll amounts at about 50 km. Ozone, being transported from the upper stratosphere downward, may account for the seasonal variation. The mechanisms of ozone changes and atmospheric circulation are presented. Day-to-day variations in total amount of ozone are related to pressure changes. The vertical transport of ozone is discussed on the basis of previous work. Some characteristics of the middle stratosphere are shown by means of constant pressure maps. The problem of ozone and changes in the Arctic stratosphere are discussed. (Author summary modified)
APTIC-22732

### DEVELOPMENT OF TRACER TECHNIQUES TO ESTABLISH GEOGRAPHICAL DISTRUBUTION OF POLLUTION FROM A STACK USING NEUTRON ACTIVATION TECHNIQUE. PROGRESS REPORT.

For primary bibliographic entry see Field 03.
APTIC-22733

### INVESTIGATION ON NEUTRON ACTIVATION STACK GAS TRACER TECHNIQUE. PROGRESS REPORT.

For primary bibliographic entry see Field 03.
APTIC-22734

### RESEARCH ON ATMOSPHERIC TURBULENCE AND ASSOCIATED DIFFUSION OF AEROSOLS AND GASES NEAR THE EARTH'S SURFACE. (FINAL REPORT).

Massachusetts Inst. of Tech., South Dartmouth, Round Hill Field Station, Contract AF 19 (604)-145, 49p., June 15, 1954. 9 refs. CFSTI, DDC: AD 037048
H. E. Cramer, G. C. Gill, and F. A. Record.
Identifiers: *Aerosols, *Diffusion, *Turbulence (atmospheric), Smokes, Anemometers, Ground level, Lower atmosphere, Plume behavior, Point sources, Tracers, Winds, Temperature (atmospheric), Sulfur dioxide, Gases.

An investigation of the physical relationships involved in the diffusion of gases and particulate matter in the lower layers of the atmosphere is reported. The structure of atmospheric turbulence was studied, and direct measurements of diffusion from a continuous point source were made. Vertical profiles of wind speed and air temperature were obtained from instruments mounted on a 40 ft tower. Preparations were completed for obtaining measurements of aerosol concentrations over a range extending 200 m downwind from a continuous point source. Sulfur dioxide was selected as a suitable tracer. An electrical method is being developed to obtain information about the instantaneous distribution of concentration within an aerosol plume. In this technique, charged smoke particles are released and measured downwind. Anemometers and bivanes are adapted to a chart-recording system which will facilitate high-speed analysis of observational data. (Author abstract modified)
APTIC-22738

### TURBULENCE AND VERTICAL CURRENTS IN THE BOUNDARY LAYER OF THE ATMOSPHERE.

(Turbulentnost' i vertical'nyye toki v pogranichnom sloye atmosfery). Leningrad, Gidrometeorologicheskoye Izdatel'stvo, 1966, 296p. 138 refs. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., 282p., Aug. 20, 1969. CFSTI, DDC: AD 698106
P. A. Vorontsov.
Identifiers: *Atmospheric movements, *Turbulence (atmospheric), Ussr, Diffusion, Winds, Stability (atmospheric).

The results of aerological investigations of airflow structure in the atmospheric boundary layer are summarized. The general laws governing dynamic, thermal, and orographic turbulences, thermals, and air waves are discussed. The conditions of formation and the structure of atmospheric eddies, longitudinal and vertical fluctuations, and their frequencies are considered. Results are given of spectral analyses of the characteristics of wind velocity fluctuations and the distribution of eddy diffusivity in the boundary layer. These results are of interest to specialists working on a wide range of theoretical and practical problems related to atmospheric physics- construction engineering, aviation, agriculture, weather forecasting, air pollution, and so forth. Almost all of the research data relates to clear weather conditions (highs), with relatively little information on airflow structures in low-cloud and frontal-cloud systems during high winds. (Author abstract modified)
APTIC-22739

### WIND TUNNEL STUDIES OF THE AIR FLOW AND GASEOUS PLUME DIFFUSION IN THE LEADING EDGE AND DOWNSTREAM REGIONS OF A MODEL FOREST.

Colorado State Univ., Fort Collins, Fluid Dynamics and Diffusion Lab., ECOM Contract DAAB07-68-C-0423, Task 1T061102B53A-17, TR-ECOM C-0423-6, CSU Rept. CER69-70RNM-BTY17, 63p., Nov. 1969. 49 refs. CFSTI, DDC: AD 703892
R. N. Meroney, and B. T. Yang.
Identifiers: *Forests, *Diffusion, *Plume behavior, Ventilation, Simulation, Testing facilities, Line sources, Winds, Turbulence (atmospheric), Flow rates.

A model forest canopy was designed to simulate the meteorological characteristics of typical live forests. Measurements were made of velocity, turbulence, drag, and gaseous plume behavior. Flow properties are compared with recent field measurements. Ground penetration in the initial fetch region results in strikingly different streamline motion as compared to wind motions within the equilibrium regions. Measured values of the vertical eddy diffusion coefficient predict plume behavior in the equilibrium region very well if a correction is included for the ratio of lateral eddy diffusion coefficient/eddy diffusion coefficient greater than 1.0. Ventilation of an elevated line source into the canopy region is compared with a simple one-dimensional model. (Author abstract)
APTIC-22753

### RAIN SCAVENGING STUDIES.

For primary bibliographic entry see Field 03.
APTIC-227[illegible]

### COMMENTS ON 'AN ATMOSPHERIC DUST FALL EXPERIMENT.'

J. Atmospheric Sci., 21 (6):704-705, Nov. 1964. 6 refs.
K. D. Hage.
Identifiers: *Deposition, *Plume behavior, Dust fall, Diffusion.

According to a recent paper, the maximum crosswind-integrated particle deposition rate should occur where the center of the 'cloud' reaches the ground, although the observed maximum was found at roughly half this distance. Various particle dispersion models predict that the maximum crosswind-integrated deposit should be found closer to the source as a consequence of eddy diffusion in the vertical. A schematic diagram is presented of a time-averaged, crosswind-integrated particle plume to illustrate the possibility of the latter behavior. The degree of vertical spreading can be substantial for a time-averaged plume because of contributions due to meander and looping under neutral and unstable conditions.
APTIC-22769

### THE USE OF LARGE-SCALE PARAMETERS IN LOWER LEVEL DIFFUSION COMPUTATIONS.

Dugway Proving Ground, Utah, Cloud Physics Branch, Rept. 4, 33p., March 6, 1956. 10 refs.
DDC: AD 089180
William G. Tank.
Identifiers: *Diffusion models, Lower atmosphere, Winds.

A method is presented whereby gaseous diffusion in the low levels of the atmosphere can be calculated by Roberts' diffusion equation (modified to consider instantaneous volume sources) using only large scale synoptic parameters that are readily obtainable from the surface analysis and pibal reports. The three pertinent meteorological parameters utilized are the mean surface wind, the angle between the surface wind vector and the surface isobars, and the height of the gradient level. Theoretical and observed dosage values are compared by means of dosage isopleth diagrams. Results show that the method yields quite satisfactory results, with regard to both dosage magnitude and distribution. The assumptions necessary for the application of the method, and their relative importance, are mentioned. The limitations of the method are also discussed. (Author abstract modified)
APTIC-22781

### THE SURVEY OF AIR POLLUTION IN AN INDUSTRIAL CITY: SHEFFIELD.

For primary bibliographic entry see Field 04.
APTIC-22785

### LONDON'S HEAT-ISLAND.

Biometeorol. Proc. 3rd Int. Biometeorol. Congr., 1963, 2 (2):589-597, 1967. 18 refs. (Sept. 1-7.)
T. J Chandler.
Identifiers: *Heat-islands, *London, *Topographic interactions, Diurnal, Seasonal, Nonurban areas, Urban areas, Winds, Clouds, Temperature (atmospheric), Heat transfer.

The London Climatological Survey was established to investigate the degree to which London's climate is the product of its urban morphology. Temperature differences between central districts and rural areas outside the city are greatest by night, in summer, and early autumn; but the intensity and form of the warm air above London on any particular day or night depends upon atmospheric conditions, particularly of wind speed and direction, and cloud amounts. The form of the warm air, or heat-island, is closely controlled by the character of the urban development, especially the density and bulk of the buildings, and the size and distribution of open spaces within the built up area. (Author abstract)
APTIC-22787

### PARTICIPATION OF PLANTS IN IONIZATION OF AIR.

(Ob uchastii rasteniy v ionizatsii vozdukha). Text in Russian. Fiziol. Rast. (Moscow), 16 (3):535-541, 1969. 20 refs.
I. L. Shidlovskaya.
Identifiers: *Plant (botany), *Ionization, Plants (botany), Ussr, Butadienes, Ions, Temperature.

Measurement of light ions in air using a Tverskiy-Otto ion meter revealed that ionization of the air is greater over plant communities, especially oak forests, than over areas without plants. Low concentrations of volatile plant emissions enhanced ion formation and increased the concentration of light ions, while high concentrations promoted ion recombination, lowering the concentration of light ions. Emission of resinous substances increased with temperature, even in dead branches, but was independent of the presence of light. Emission of isoprene, however, occurred only in green leaves in the presence of light and showed no temperature dependence.
APTIC-22799

### THEORETICAL DERIVATIONS AND NOMOGRAPHIC METHODS FOR SUTTON'S DIFFUSION EQUATIONS.

Dugway Proving Ground, Utah, Proj. 4-98-05-026-01, DPGRR 107, 74p., Sept. 10, 1956. 31 refs.
CFSTI, DDC: AD 113307
Harvey Greenfield.
Identifiers: *Mathematical analyses, *Diffusion, Point sources, Fallout.

A survey of diffusion equation solutions is presented, including hypotheses underlying their derivations and limitations to their applicability. Sutton's diffusion equations are treated, since they are the most widely accepted equations available. Sutton's formula for an instantaneous point source is the focal point; interest is centered primarily in the effect on diffusion from a bomb burst. The solutions are derived from a Fickian equation which is similar to the heat conduction equation. The theory of nomograms as applied to Sutton's results is treated extensively in order to show the power of its use, possible extensions of the resulting diagrams, and the necessary results for forming new nomograms for diffusion calculations. (Author abstract modified)
APTIC-22807

### DETAILED TIME-HISTORIES OF CONCENTRATION RESULTING FROM PUFF AND SHORT-PERIOD RELEASES OF AN INERT RADIOACTIVE GAS: A VOLUME OF ATMOSPHERIC DIFFUSION DATA.

Battelle Northwest, Richland, Wash.,
Environmental and Life Sciences Div., 201p., Feb. 1970. 6 refs. CFSTI: BNWL-1272
P. W. Nickola, J. V. Ramsdell Jr., and J. D. Ludwick.
Identifiers: *Diffusion, *Radioactive tracers, Ground level, Lower atmosphere, Tracers, Transport, Meteorology, Winds, Temperature (atmospheric).

Atmospheric diffusion data is presented in exceptional detail. The concentration measurements in this report were obtained from the release of the radioactive gas krypton-85 as an atmospheric tracer. Measurements were made simultaneously on a real-time basis at 64 field locations. The sampling array, arranged on sampling arcs at distances of 200 and 800 m from the tracer release point, consisted of 40 Geiger-Mueller tubes at elevations of 1.5 m above the surface, with 24 more tubes located on six towers. Tower sampling extended to heights of 21 m. Eight of these inert gaseous tracer releases were in the form of instantaneous bursts or puffs, while the remaining five releases took the form of plume releases of 10 to 20 min duration. Vertical wind and temperature profiles for the periods of tracer transport are given. A description of the field system and field techniques is also included.
APTIC-22811

### FORMATION AND EVOLUTION OF AEROSOLS IN FILTERED AIR AND IN NATURAL AIR. EFFECT OF RADIOACTIVITY.

(Formation et evolution des aerosols dans l'air filtre et dans l'air naturel. Action de la radioactivite). Text in French. Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France), Service Technique D'Etudes de Protection, Rept. CEA-R-3614, 77p., Dec. 1968. 52 refs.
Guy J. Madelaine.
Identifiers: *Aerosols, *Ions, *Radioactive radiation, France, Analytical methods, Sampling methods, Sulfur dioxide, Photochemical reactions, Photoionization, Gases, Electrical properties.

In filtered and unfiltered air, electrically neutral particles are produced which are partly visible to a condensation nuclei counter and whose maximum radius at the instant they become detectable is approximately 10 to the minus 7th cm. These particles are formed by photochemical reactions in sunlight among gaseous impurities which could not be identified but among which sulfur dioxide appears to play a dominant role. When these particles are in the presence of an aerosol, they attach themselves to larger nuclei. Natural radioactive gas present in filtered and unfiltered air has an influence on the production of particles by radiolysis. The simultaneous study of the descendants of the radioactive gases and the radiolytic particles indicates that the behavior of the radioactive ions and particles depends on the impurity content of the air and the concentration of the aerosols present. The existance of neutral particles of thorium B which have a long life, a slow evolution, and whose dimensions are comparable to those of small ions was demonstrated. These findings were used in designing improved sampling and analytic devices for ultra-fine particles and for demonstrating the shortcomings of similar devices currently in use. Discussion pertaining to the implications of these findings is included.
APTIC-22818

### SOME ASPECTS OF THE DISPERSION OF POLLENS AND INDUSTRIAL CONTAMINANTS IN RELATION TO MICROMETEOROLOGY.

Michigan Univ., Ann Arbor, Engineering Research Inst., AFCRC Contract AF 19 (604)-792, Proj. 2160, SR-1, 44p., Oct. 1953. 80 refs.
E. Wendell Hewson.
Identifiers: *Pollens, *Dispersion, *Micrometeorology, Mortality, Allergies, Cancer, Asthma, Bronchitis, Pneumonia, Spores, Dusts, Smokes, Particle size, Gravity settling, Rain, Weather modification, Turbulence (atmospheric), Carbon dioxide, Sulfur dioxide, Infrared radiation.

Many micrometeorological aspects are involved in the dispersion and penetration of pollens and industrial contaminants. Published research on the dispersion of pollens and industrial contaminants is critically reviewed. There is apparently no published material on penetration. Absorption of infrared radiation by carbon dioxide is discussed, and production and consumption figures for $CO_2$ are listed. There is no evidence that dust and smoke are modifying the climate. Mortality from respiratory diseases may be increased by smoke pollution. Asthma may be precipitated by smoke, and perhaps by sulfur dioxide. There is no evidence that cancer is induced by smoke. Atmospheric pollution by aeroallergens such as pollens and spores causes hay fever and a substantial amount of asthma. Large particles are removed from the atmosphere by turbulence and gravity settling, and by rain washing. Small particles may be deposited in ice crystals or onto surfaces. (Author abstract modified)
APTIC-22857

### STUDIES ON ICE FOG. (FINAL REPORT).

Alaska Univ., College, Geophysical Inst., NAPCA Grant AP-00449, UAG R-211, 177p., June 1970. 81 refs.
Takeshi Ohtake.
Identifiers: *Fog, *Ice, Alaska, Dusts, Droplets, Visibility, Particle size, Humidity, Temperature (atmospheric), Condensation, Freezing, Nucleation, Vapors, Electrical properties, Surface properties.

In order to clarify the mechanism of ice fog formation, a number of atmospheric factors in ice fogs such as size and concentration of crystals, condensation nuclei and ice nuclei, amount of water vapor, and temperature profile are measured. Dust particles from air pollution are not essential for formation of ice fog; they merely stimulate freezing of water droplets at higher temperatures than the spontaneous freezing temperature. Based on measurements and time required for water droplets to freeze, a physical mechanism of ice fog formation is proposed. Measurements of humidity and evaporation rates from open water at low air temperatures are described, as are some phenomena relating to ice crystals found in ice fog. The types of meteorological situations which are likely to cause ice fog, visual range in ice fog, and the electric properties and theoretical studies of size distribution of ice fog crystals are also described. (Author abstract modified)
APTIC-22858

### ATMOSPHERIC HAZE: A REVIEW.

Bolt Beranek and Newman Inc., Cambridge, Mass., Contracts CAPA-6-68 (1-68) and CPA 22-69-29, Rept. 1821, 173p., March 31, 1970. 388 refs.
CFSTI: PB 192102
O. A. Germogenova, J. P. Friend, and A. M. Sacco.
Identifiers: *Aerosols, *Haze, Urban areas, Oceans, Dusts, Sea salts, Sprays, Visibility, Measurement methods, Sampling methods, Diffusion, Winds, Humidity, Temperature (atmospheric), Scattering (atmospheric), Topographic interactions, Turbulence (atmospheric), Nitrogen dioxide (no2), Sulfur dioxide, Photooxidation.

A review of important trends in haze research is presented. Haze identification depends upon chemical composition, number and weight concentration, size distribution, and relative humidity. Natural aerosols consist of Aitken nuclei resulting from condensation, chemical reactions, or dispersion by wind of dusts or sprays. Analyses of the chemical composition of hazes over oceans and land masses (particularly over urban areas) are given. Photooxidation and catalytic oxidation of sulfur dioxide, as well as nitrogen dioxide reactions which produce natural hazes are mentioned. Size distribution due to turbulent diffusion, temperature, wind, and topography is discussed. Optical properties of air pollutants, including visibility, scattering, and polarization are described. Instrumentation for measuring hazes includes the polarimeter, filters, photometer, separators, Konimeter, cascade impactor, impinger, and paper-tape sampler.
APTIC-22859

### MODELING URBAN ATMOSPHERIC TEMPERATURE PROFILES.

Illinois Univ., Urbana, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., Feb. 1968, 159p. 151 refs.
Mackenzie Leo Davis.
Identifiers: *Heat island, *Urban areas, *Micrometeorology, Mathematical modeling, Precipitation, Temperature (atmospheric), Topographic interactions, Heat transfer.

A micrometeorological model which can perform a temperature profile distortion similar to the one produced by the full scale phototype is presented. The model is intended to simulate the heat island effect in the city of Fort Wayne, Indiana. The radiation characteristics of Fort Wayne are quite similar to those of rural environs; thus, radiation alteration does not contribute significantly to the heat island effect. From a discussion of the energy balance equation it appears that the heat island effect is due primarily to the heat generated from human activity and the more efficient heat storage properties of the city structure. The vertical distortion of the model does not significantly alter the validity of applying the horizontal scale factor. About 10% of the precipitation falling on the urban area is lost to the sewers, but increased urban precipitation compensates for this loss, thus negating the expected 10% excess energy availability.
APTIC-22866

### THE PHOTOCHEMICAL OXIDATION OF SULFUR DIOXIDE TO SULFUR TRIOXIDE AND ITS EFFECT ON FOG FORMATION.

Illinois Univ., Urbana, Engineering Experiment Station, American Petroleum Institute Contract SF-9, TR-1, 101p., Oct. 1, 1953. 40 refs.
Earl R. Gerhard.
Identifiers: *Fog, *Sulfur dioxide, *Photooxidation, Aerosols, Particle size, Visibility, Humidity, Sulfuric acid, Sodium chloride, Nitrogen dioxide (no2), Sulfur trioxide, Gases, Reaction kinetics.

The photochemical oxidation of sulfur dioxide to sulfur trioxide in air at concentrations of 5 to 30 ppm was investigated. Nitrogen dioxide in concentrations of 5 to 20% of the SO2 concentrations has no significant effect on the reaction rate. The presence of sodium chloride nuclei and variation of the relative humidity also have no effect. The particle size of the sulfuric acid aerosol produced is very small, varying from 0.2 to 0.4 micron in diameter. The sulfuric acid aerosol produced cannot be important in reducing the visibility under conditions ordinarily found in the atmosphere. This refers only to the photochemical gas phase oxidation; different results may be obtained by oxidation in the liquid phase, such as in the presence of a natural water fog. (Author conclusions modified)
APTIC-22870

### APPLICATION OF DIFFUSION THEORY TO DISPERSION OF STACK GAS IN THE ATMOSPHERE.

Defence Research Chemical Labs., Ottawa
(Ontario), Proj. D52-89-30-03, Rept. 110, 36p.,
Sept. 1952. 23 refs.
Morris Katz.
Identifiers: *Stack gases, *Stacks, *Diffusion models, Canada, Smokes, Air quality measurements, Altitude, Ground level, Winds, Turbulence (atmospheric), Sulfur dioxide, Temperature.

Data on measured ground concentrations of sulfur dioxide in the Trail, B. C., and Sudbury, Ont., smelter areas was utilized to test the atmospheric diffusion theories of Sutton and of Bosanquet and Pearson. Effective stack heights were employed which take into account the rise of the smoke above the source in various wind speeds due to the velocity and temperature of the gases issuing from the stack. The effect of turbulence on vertical distribution is discussed. Data are also presented on the vertical distribution of smoke in the Sudbury area from gas samples collected by apparatus transported at various altitudes in aircraft flights. The Bosanquet-Pearson equation of diffusion cannot apply to these cases. Good correlation between predicted and measured gas concentrations is obtained, however, by application of Sutton's diffusion theory. (Author abstract modified)
APTIC-22878

### EXPERIMENTS WITH PILOT BALLOON SOUNDINGS AT SOME POWER STATION SITES.

Phil. Trans. Roy. Soc. London, Ser. A, 265
(1161):183-190, Nov. 13, 1969. 10 refs.
M. Pagliari.
Identifiers: *Balloons, *Plume behavior, Italy, Mountains, Plains, Electric power production, Stacks, Height finding, Lower atmosphere, Dispersion, Diffusion, Winds, Stability (atmospheric), Topographic interactions.

Data on the motion and layering of the lower atmosphere between 75 and 1500 m were obtained for three power station sites in Italy by use of a standard pilot balloon technique. On the shore of the Ligurian Sea with surrounding foothills, with north or northwest winds, the plume from a tall stack will be embedded in a thick body of moderately stable air, so that diffusion formulae can be reliably employed to derive the requisite height of a tall stack. On the bank of the Po River, in flat country, a plume emitted at about 200 m will develop above a very stable layer, effectively preventing any transport to the ground. Above 300 m, the likelihood of pollutant dispersion by wind is enhanced. Thus for new plants, stacks should be over 200 m high. In a 300-m hollow surrounded by 600-700-m ridges, analysis showed a discontinuity in the wind field. Meteorological conditions there cannot assist dispersion; thus, pollution control must be achieved at the source, in this case by additional electrostatic precipitators. It is concluded that despite the limitations of the method, pilot balloon sound is still a simple and economic method that in difficult situations can provide useful qualitative information no worse than that from inappropriate use of formulae.
APTIC-22884

### THE PREDICTION OF THE RISE OF A HOT CLOUD FROM FIELD EXPERIMENTS.

J. Air Pollution Control Assoc., 14 (11):455-458,
Nov. 1964. 11 refs. (Presented at the Air Pollution
Control Association, Annual Meeting, 57th,
Houston, Tex., June 21-25, 1964.)
Irving A. Singer, John A. Frizzola, and Maynard
E. Smith.
Identifiers: *Mathematical modeling, *Air pollution forecasting, *Plume behavior, Fuels, Missiles and rockets, Ground level, Diffusion, Meteorology, Inversion, Lower atmosphere.

Preliminary data on the rise of a hot cloud resulting from combustion of a solid propellant rocket fuel at ground level are presented, determined from time-lapse movies and visual aircraft observations in field tests conducted near 420- and 160-ft meteorological towers under various atmospheric conditions. Heat release rates ranged from 10,000 to one million cal/sec. A method of predicting the maximum thermal rise of a cloud is described in which a curve is fitted to the date representing the rise at the top of the hot plume for the appropriate meteorological conditions. By successive approximation, a virtual height is derived for the ambient source which will match the straight line portion of the original data curve. Comparisons with other theoretical formulations, especially with Priestley's theory of the rise of a hot plume, are discussed. The date indicate that a cloud released during surface temperature inversions not only rise virtually intact to a predictable height above ground, but the condition may in many cases be excellent for release of a contaminant, especially if there is assurance that the hot plume will break through the surface inversion and reach more vigorous turbulence above. In some cases, it was observed that during an inversion, active diffusion continued in the plume aloft while no material returned to ground level; it is suggested that the 'dreaded' inversion condition may sometimes be the best possible situation.
APTIC-22886

### METEOROLOGICAL CONSIDERATIONS IN AIR QUALITY PLANNING.

Preprint, Air Pollution Control Association, New
York City, 15p., 1959. 10 refs. (Presented at the
Air Pollution Control Association, Annual
Meeting, 52nd, Los Angeles, Calif., June 26,
1959.)
Jack M. Leavitt.
Identifiers: *Survey methods, *Planning and zoning, *Diffusion models, Area surveys, Industrial areas, Transport, Winds, Stability (atmospheric).

A method is suggested for evaluating community air-quality potential for application to community planning. Transport and dispersive characteristics of a local atmosphere are discussed in terms of wind direction, wind speed, and atmospheric stability. Using standard atmospheric diffusion equations, community-wide patterns of relative concentrations are computed for pollutants emitted from geographical zones (potential source areas) marked for industrial development. Such patterns may provide a comparative index of pollutant contributions from the industrial zones, enabling the city planner to select industrial development areas from which pollution will least affect the community. An example of the suggested methodology is applied to Tulsa, Oklahoma, where the Air Pollution Engineering Research unit of the Public Health Service, in cooperation with local agencies, is conducting an air resources survey designed to evaluate the local meteorological features for application to land-use planning. (Author abstract)
APTIC-23353

### SULFURIC ACID AND THE PH OF RAINWATER-FACT OR SPECULATION.

(Svaveldioxiden och nederbordens forsurning.
Facta och spekulationer). Text in Swedish. Inst.
for Vatten - och Luftvardsforskning, Stockholm
(Sweden), IVL (Inst. Vatten -Luftvardsforskning)
Konf. - 1968, p. 86-96.
Erik Eriksson.
Identifiers: *Rain, *Sulfuric acid, *Ph, Sweden, Sulfates.

The sulfate content of rainwater has been increasing and the pH values decreasing throughout Europe. During the 1950's, an excess of buses (30 to 80 m ekv/sq m year) was observed in most areas of Sweden. By mid 1960, acids in rainwater collected in southern Sweden reached 100-200 m ekv/sq m year. The present situation gives an excess of about 0.5 tons of sulfuric acid per sq km a year.
APTIC-23362

### EFFECT OF THE ATMOSPHERE ON ELECTROMAGNETIC SENSING OF THE EARTH'S RESOURCES FROM A REMOTE PLATFORM.

Preprint, TRW Systems, Redondo Beach, Calif.,
98p., 1968. 56 refs. CFSTI: N 70-14074
Robert S. Fraser, and G. A. Cato.
Identifiers: *Electromagnetic sensing, *Spectrometry, *Atmospheric phenomena, Mathematical analyses, Clouds, Haze, Precipitation, Temperature (atmospheric), Scattering (atmospheric), Turbulence (atmospheric), Infrared radiation, Solar radiation, Visible radiation.

The earth's atmosphere and substances within it scatter and absorb radiant energy. Hence, information transmitted through the atmosphere by radiant energy from an earth resource to a distant platform is attenuated and distorted. The atmosphere also adds background noise. The general characteristics of the atmosphere, associated phenomena such as the characteristic temperature of successive layers, clouds, precipitation, and haze, and sources of radiant energy that relate to sensing of the earth from a remote platform above the earth are presented. Computations of radiance and flux for many applications are made from solutions to the equation of radiative transfer. This method will be applied to the entire spectrum. Random effects resulting in distorted and displaced images are caused by aymospheric turbulence and are analyzed differently. The electromagnetic spectrum is divided into three spectral bands that are used for satellite sensing. The first band is the visible and near-visible band of 0.29-0.75 micron wavelength. Scattering processes are most important for this band. The next band is the infrared one that extends from 0.75-22 micron. Both scattering and absorption processes are significant in this band. The last band is the microwave one and extends from 0.1 cm-30 m. The remaining spectral bands are essentially opaque for satellite sensing; but useful information is obtained in them from low-flying aircraft.
APTIC-23375

### THE INFLUENCE OF ATMOSPHERIC PARTICULATES ON THE INFRARED RADIATION BALANCE OF NORTHWEST INDIA.

American Meteorological Society, Boston, Mass.,
Proc. Natl. Conf. Weather Modification, 1st, 1968,
p. 153-162. 20 refs. (April 28-May 1.)
James T. Peterson, and Reid A. Bryson.
Identifiers: *India, *Aerosols, *Weather modification, *Infrared radiation, Asia, Dusts, Particle size, Lower atmosphere, Precipitation, Carbon dioxide, Light scattering, Water, Vapors.

The possibility that elimination of the aerosols from the atmosphere over northwest India would lead to a modification of the climate of that area is investigated. Atmospheric dust influences the infrared cooling of the mid-troposphere and subsequently affects the subsidence and precipitation patterns of the region. The effects of quartz aerosols, water vapor, and carbon dioxide on infrared radiation transfer are considered. Particle

size distribution and radiation measurements are described. The mass concentration of dust over the Indian countryside is of the same order of magnitude as that of a heavily polluted city in the United States. Radiation flux and light scattering measurements are described.
APTIC-23380

### ATMOSPHERIC DIFFUSION OF IMPURITIES DURING A CALM.

In: American Institute of Crop Ecology Survey of
Ussr Air Pollution Literature. Vol. IV.
Meteorological and Chemical Aspects of Air
Pollution; Propagation and Dispersal of Air
Pollutants in a Number of Areas in the Soviet
Union. M. Y. Nuttonson (ed.), Silver Spring, Md.,
American Institute of Crop Ecology, 1970, p. 11-
23. 18 refs. (Also: Tr. Gl. Geofiz. Observ.
(Leningrad), no 238:3-13, 1969.)
M. Ye. Berlyand, and O. I. Kurenbin.
Identifiers: *Ground level, *Diffusion models, *Winds, Ussr, Plume behavior, Point sources, Stagnation.

When the wind velocity dies down to a calm, high concentrations of impurities can build up the ground layer of air. However, the formulas for the calculation of impurity dispersal that are used at the present time pertain to conditions in which the wind velocity is substantially different from zero. Attempts to derive expressions for calm diffusion are related; the various assumptions regarding sources, time factors, and areas of maximum concentration are explained. A formula is derived which makes it possible to calculate the maximum ground concentration, both in the presence and absence of wind.
APTIC-23398

### COMPLEX SCATTERING OF LIGHT IN TURBID MEDIA. (CHAPTERS I AND II).

Tr. Morsk. Gidrofiz. Inst., Akad. Nauk SSSR, vol.
3:35-81, 1953. 19 refs. Translated from Russian.
Foreign Technology Div. Wright-Patterson AFB,
Ohio, Translation Div., 71p., June 17, 1969.
CFSTI, DDC: AD 695946
V. A. Timofeyev.
Identifiers: *Light scattering, *Turbidity, Diffusion, Light radiation, Solar radiation.

The objective of the work was a study of diffusion of light in strongly turbid media, i.e., those in which it is impossible to disregard multiple light scattering. In the absence of experimental data on the phenomenon, laboratory investigations were undertaken to measure distribution of strongly turbid media under various conditions of illunimation of the media and to establish regularities between the assigned parameters of a medium and basic values characterizing the distribution of brightness in that media. Data were obtained on the illumination of a medium by a flux of solar rays which is normal to its surface and on the illumination of a medium by 'oblique' solar rays and celestial scattered light. Twenty-one conclusions were reached concerning: a) strongly turbid media with a large scattering coefficient and insignificantly small coefficient of absorption with infinite dimensions of the medium and during illumination of it by a vertical infinitely wide flux of solar rays; b) the general picture of distrubution of brightness in turbid media which are illuminated by 'slanting' rays; and c) the same picture for media illuminated only by celestial scattered light.
APTIC-23402

### EFFECT OF A SUDDEN CHANGE IN TERRAIN HEIGHT ON THE THREE-DIMENSIONAL LOW-LEVEL AIR FLOW, AS ESTIMATED FROM TETROON FLIGHTS.

Monthly Weather Rev., 97 (12):845-849, Dec. 1969.
5 refs.
W. H. Hoecker, and J. K. Angell.
Identifiers: *Winds, *Topographic interactions, *Tetroons, Mountains, Oceans, Meteorological instruments, Lower atmosphere, Transport.

Tetroon flights across the northern California coast indicate the influence of a laterally extensive and fairly abrupt 100-m change in terrain height near the shoreline on the three-dimensional low-level air flow. Beneath the wind speed maximum at a height of 300 m, the wind speed is stronger over the land than over the sea, resulting in equal horizontal mass transport between this height and the earth's surface. Across the 4-km interval bracketing the shoreline, the wind backs by 11 deg and 4 deg at 200 and 400 m, respectively. The maximum upward velocity (6 cm reciprocal sec) occurs 250 m above the sudden change in terrain height near the shoreline, with the compensating downward motion commencing 3 km inland. Over the hills inland from the coast, the magnitude of the tetroon height variation is closely related to the magnitude of the height variations of the underlying terrain, with tetroon oscillations in the vertical generally preceeding the variations in terrain height by a distance exceeding the height of the tetroon above the ground. The flights reported demonstrated the usefulness of the tetroon for probing the atmosphere in regions and at heights not easily accessible to Eulerian-type measurements. (Author abstract modified)
APTIC-23405

### FATE OF SULFUR DIOXIDE IN A PLUME.

Florida Univ., Gainesville, Coll. of Engineering,
Thesis (Ph.D.), Ann Arbor, Mich., Univ.
Microfilms, Inc., 1969, 222p. 72 refs.
Nolan Thomas Stephens.
Identifiers: *Decay rate, *Plume behavior, *Sulfur dioxide, Particulates, Electric power production, Primary metallurgical processing, Diffusion, Tracers, Humidity, Reaction mechanisms.

Current models for predicting sulfur dioxide concentrations after emission from industrial sources are limited by a lack of information on its decay rate or half-life. In this study, an instrumented aircraft was utilized in tracking sulfur dioxide and particulate matter after emission from power plants and smelters. Sulfur dioxide decay rates were ascertained by comparison of simultaneous sulfur dioxide and particulate matter concentrations. The particulate matter, 0.3 to 1.0 micron 'combustion spherules', emitted from the source served as a conservative tracer. Both SO2 and particulate concentrations were measured by a rapid response technique (less than two seconds delay), which permitted evaluation of the ratio of concentrations at any given point. An increase in the particulate to SO2 ratio was indicative of a loss of SO2, since the particulate matter was essentially a conservative element. The measurement techniques were effective up to 80 km. The results show that available moisture is a major factor in the decay of sulfur dioxide in smelter and power plant plumes. The half-life of SO2 was on the order of one hour at 75-80% relative humidity and on the order of two hours at 40-50% relative humidity. There was no detectable decay at 30-40% relative humidity. A first order reaction mechanism, combined with experimentally determined plume spread coefficients, provides a reasonable approximation of the decay and diffusive effects in plumes. (Author abstract modified)
APTIC-23409

### TWO ATMOSPHERIC CONSTITUENTS: OZONE AND SMALL IONS.

Minnesota Univ., Minneapolis, School of Physics.
Navy Contract Nonr 710 (22), 78p., Sept. 1962. 34
refs. CFSTI: AD 289326
John L. Kroening.
Identifiers: *Diffusion, *Ozone, Diurnal, Air quality measurements, Altitude, Ground level, Lower atmosphere, Transport, Advection, Winds, Temperature (atmospheric), Recombination, Ions.

A chemiluminescent detector based on the reaction between ozone and rhodamine B absorbed on silica gel was developed for ground-level measurements of ozone and measurements of the vertical distribution of ozone at high altitudes. The ground-level measurements revealed diurnal variations in ozone that are related to the magnitude of surface-level winds and sky cover. The variations implied the existence of an ozone sink at the earth's surface, the value of which was determined by measurements of vertical ozone distribution and vertical temperature distribution. Equations derived to describe the kinetic properties of the sink demonstrate the possibility that the majority of ozone distribution may be diffusion controlled and that horizontal diffusion and advection may be important for gross features. The observed correspondence between the ozone measurements and the temperature profiles suggests that diffusive transport is controlled to a large extent by the temperature distribution, and that no large quantities of ozone enter the troposphere. The diffusion-controlled process is advocated up to the level where photochemical time constants become comparable to the residence time consistent with the diffusive process. This level is probably in the neighborhood of 25 km in the vicinity of the observed ozone maximum, which is lower than the photochemical maximum due to the interplay between diffusive and photochemical processes. Balloon soundings with the detector demonstrated the existence of thin stable laminae, or ozone rivers, that are attributed to the vertical advection of air between the stratosphere and the troposphere. These rivers descend through the atmosphere and retain an ozone concentration characteristic of there origin. The ozone measurements reported suggest that electric discharge, as well as solar energy, is a source of ozone. Additional data is presented on small ion-large nuclei recombination processes at high altitudes.
APTIC-23412

### MAN'S INADVERTENT MODIFICATION OF WEATHER AND CLIMATE.

In: Environmental Quality, The First Annual
Report of the Council on Environmental Quality
together with the President's Message to
Congress. 91st Congress, Second Session, p. 93-
04, Aug. 1970.
Personal Author Not Recorded.
Identifiers: *Temperature (atmospheric), *Weather modification, Urban areas, Volcanoes, Particulates, Dusts, Fuels, Micrometeorology, Carbon dioxide, Thermal radiation.

Over the past 30 years, man has significantly affected climate by increasing the carbon dioxide content of the atmosphere through the burning of fossil fuels. As a result, the average temperature of the earth's surface has increased by several tenths of a degree Fahrenheit. However, the heating effects of carbon dioxide are apparently being counteracted by apparent changes of atmospheric transparency caused by volcanic dust and perhaps by industrial and agricultural activities. It is also possible that the burning of fossil and nuclear fuels and water vapor from the combustion of jet fuels will upset the natural radiation balance of the atmosphere. Though man's contribution to the net radiation gain of the atmosphere is still too small to influence climate on a large scale, it is sufficient to alter local climates of cities; and the combined effect of heat input escaping from many cities may eventually alter regional and global climates. Worldwide ground monitoring and satellite monitoring, combined with extensive research, are necessary to preserve the atmosphere from the warming effects of carbon dioxide and heat pollution or the cooling effect of particle pollution.
APTIC-23422

### DIFFUSION OF POLLUTANTS FROM A LINEAR SOURCE IN A GROUND LAYER WITH UNSTABLE STRATIFICATION.

(Diffuziya primesi ot lineynogo istochnika v
prisemnom sloye pri neustoychivoy stratifikatsii).
Text in Russian. Izv. Akad. Nauk SSSR,
Atmosfery i Okeana, 4 (6):677-679, 1968. 7 refs.
D. L. Yordanov.
Identifiers: *Diffusion models, Ussr, Ground level, Diffusion, Line sources, Topographic interactions.

A semiempirical formula is derived to describe diffusion from a continuous linear pollution source of fixed power and known height above a perfectly reflective surface. This expression is suitable for estimating pollutant concentration at limited distances from a sufficiently low source. Applicability is extended significantly when stratification of the ground layer is close to equilibrium.
APTIC-23426

### TERRAIN INFLUENCE ON ATMOSPHERIC DIFFUSION.

In: Pacific Northwest Laboratory Annual Report
for 1969 to the USAEC Division of Biology and
Medicine. Volume II: Physical Sciences. Part 1.
Atmospheric Sciences. Battelle Northwest,
Richland, Wash., Environmental and Life
Sciences Div., p. 19-20, June 1970. CFSTI:
BNWL-1307, Part 1
W. T. Hinds.
Identifiers: *Diffusion, *Topographic interactions, *Mountains, Point sources, Winds.

For many years, most diffusion research concentrated on diffusion over relatively flat terrain. However, Operation Mountain Iron marked the beginning of intensive research into the influence of mountainous terrain on diffusion. As determined by an analysis of the data obtained in the study, time and distance regression are related. This relationship permits relations between meteorological variables to be predicted. A comparison of the results from Mountain Iron with those from earlier tests on flatter terrain suggests an interaction between roughness and concentration variability. Evidence that rough terrain decouples diffusion from source point meteorological conditions is shown. Another conclusion is that crosswind and vertical dispersion appear to be approximately commensurate over rough terrain during daytime conditions.
APTIC-23446

### RELATION BETWEEN AMOUNTS OF DUSTFALL AND PRECIPITATION.

Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 2
(1):96-98, 1967. Translated from Japanese. 10p.
Hidemi Kurita.
Identifiers: *Deposition, *Dust fall, *Precipitation, Japan, Dusts, Sedimentation, Mathematical modeling, Rain, Snow.

The deposition rate of air pollutants increases with the amount of precipitation, the rate of increase being dependent on the pollutant material; rain and snow provide different rates. An investigation was made of the relationship of amounts of deposition of pollutants and of precipitation. A numerical representation of the relationship was derived. A mathematical expression was established for the rate of sedimentation in terms of the amount of sedimentation and the amount of precipitation. A model was constructed from 12 data on dustfall and precipitation. The rate of deposition by sedimentation was calculated by the method of least squares. The rate of sedimentation in mm/mo obtained was higher for rain than for snowfall and higher for insoluble components than for soluble components.
APTIC-23454

### PHOTOCHEMICAL STUDY OF AIR POLLUTION (I). PRODUCTS OF PHOTOCHEMICAL REACTIONS OF HYDROCARBONS AND A MIXTURE OF HYDROCARBONS AND NO2.

Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 2
(1):96-98, 1967. Translated from Japanese. 10p.
Noboru Yamate.
Identifiers: *Hydrocarbons, *Nitrogen dioxide (no2), *Photochemical reactions, Japan, Methanes, Butadienes, Ethylenes, Propanes, Solar radiation, Gases.

A study intended to photochemically explain the mechanism of urban air pollution is reported. Materials produced by the irradiation of hydrocarbons and a mixture of hydrocarbons and nitrogen dioxide were identified and measured. The sample gas contained in a 1 liter silica vessel was irradiated by the sun, a xenon lamp, and an ultrahigh pressure mercury lamp. The solar irradiation was carried out between 9 am and 4 pm on clear days. Duration of the irradiation by lamps was 1, 3, 6, or 16 hours; 1000 ppm each of methane, propane, ethylene, butylene, and 1,3-butadiene in air were subjected to irradiation. The concentration of NO2 was 700 ppm in air. The analysis of gases was made using an infra-red spectrometer which was attached to a gas cell 10 m in length and by the colorimetric method. Neither qualitative nor quantitative results are reported.
APTIC-23455

### CONSEQUENCES OF ACTIVITY RELEASE. THE AREA WITHIN GROUND-LEVEL DOSAGE ISOPLETHS.

Nucl. Safety, 4 (2):91-92, Dec. 1962.
F. A. Gifford Jr.
Identifiers: *Mapping, *Diffusion models, *Radioactive radiation, Reactors (nuclear), Ground level, Winds, Stability (atmospheric).

The total radioactive dosage to a population is an important aspect of the potential hazard associated with reactor accidents. A reasonably simple means for computing this quantity is a useful tool. The total population dosage is equal to the product of people times radioactive dosage, summed over the population, with appropriate high and low dosage cutoffs taken into account. Based on ground level air concentration isopleths, the area enclosed by a range of concentration values as a function of diffusion types can be calculated. Recent studies involving ground level sources are discussed. Formulas are derived for the area within a concentration isopleth, taking into consideration atmospheric stability and winds.
APTIC-23467

### A NOTE ON HORIZONTAL DISPERSION FROM AN INSTANTANEOUS GROUND SOURCE.

Quart. J. Roy. Meteorol. Soc. (London), 89
(382):542-545, Oct. 1963. 8 refs.
J. H. Gee, and D. R. Davies.
Identifiers: *Ground level, *Diffusion models, Great britain, Particulates, Point sources, Advection.

A mathematical treatment of horizontal dispersion from an instantaneous ground source is presented. The shearing advection term is introduced into an analysis of the diffusion equation. The case of an instantaneous point source emitted at ground level is considered when the height of diffusion can be assumed to be unlimited. In this case, formulae are obtained describing the position of the centroid and the downstream standard deviation at ground level of a cloud of marked particles as functions of time. This work is based on a form of analysis which was used initially in discussing longitudinal diffusion of material in laminar flow through a tube. The introduction of a shearing advection term leads to formulae which predict respectively a 16% and a 20% decrease in numerical values compared with previous analyses. If, in addition, eddy diffusivities which are assumed to depend linearly on time are introduced, the respective decreases are 19% and 25%. (Author abstract modified)
APTIC-23468

### ICE NUCLEI, THEIR PHYSICAL CHARACTERISTICS AND POSSIBLE EFFECTS ON PRECIPITATION INITIATION.

Proc. Intern. Conf. Cloud Phys., Tokyo, Sapporo,
Japan, 1965, p. 55-162. 18 refs. (May 24-June 1.)
A. Gagin.
Identifiers: *Rain, *Ice, Asia, Soils, Dusts, Particle counters, Particle size, Particulate sampling, Membrane filters, Ionization chambers, Clouds, Cloud seeding, Nucleation.

The behavior of atmospheric ice nuclei and their role in precipitation initiation were studied. Cloud chamber techniques for conducting nuclei counting experiments and millipore filter techniques for the determination of nuclei concentration are described. Field measurements, both on the ground and from aircraft of the Jerusalem area are reported. Daily variation of the ice nuclei is tabulated; the possible influence of dust storms is considered. An analysis of the local types of soil is included. Size distributions of the nuclei are determined. Cloud seeding experiments are based on the hypothesis that ice nuclei contribute to precipitation. From the recorded data, there seems to be no correlation between nuclei counts and rainfall. Rainfall depends upon cloud top temperature and total precipitable water in the atmosphere.
APTIC-23470

### DETERMINATION OF THE COEFFICIENT OF VERTICAL TRANSFER OF MATTER THROUGH TURBULENT DIFFUSION USING THE ELECTRICAL PARAMETERS OF AIR.

(Determination du coefficient de transfert vertical
de matiere par diffusion turbulente a partir des
parametres electriques de l'air). Text in French. C.
R. Acad. Sci., Paris, Ser. B, vol. 269:681-684, Oct.
13, 1969. 9 refs.
Alain Milhau, Aime Druilhet, Jacques Fontan, and
Jean Bricard.
Identifiers: *Mathematical modeling, *Transport, *Electricity (atmospheric), France, Aerosols, Diffusion, Turbulence (atmospheric).

The values of the coefficient of vertical transfer, obtained through the electrical parameters of air are compared with the values obtained through dosing thoron at different levels; measurements being conducted simultaneously and in the same ambient conditions. The theoretical model proposed is based on an interpretation of the electrode effect of the ground analogous to the Whipple cell. It allows determination the coefficient of vertical transfer using: electric field E, space charge ro, conductivity lambda. A mathematical model is presented in which the vertical current I is the sum of two factors, one proportional to the electric field E and lambda, the other proportional to the coefficient of diffusion wanted K and the derivative of the space charge ro with respect to the altitude. Various schematization are introduced. Results are reported in a histogram showing how close measurements of the coefficient of vertical transfer, obtained with the thoron method are to the values obtained throuth calculations. For 70% of the measurements the calculated value lies between 70% and 130% of the value obtained through the thoron method. Taking into account the approximations and the precision of the measurements the results are considered satisfactory.
APTIC-23472

### METEOROLOGICAL ASPECTS OF AIR POLLUTION. THE INFLUENCE OF THE TURNING OF WIND WITH HEIGHT ON CROSSWIND DIFFUSION.

Phil. Trans. Roy. Soc. London, Ser. A, 265
(1161):173-181, Nov. 13 1969. 9 refs.
F. Pasquill.
Identifiers: *Mathematical analyses, *Plume behavior, *Winds, Great britain, Lower atmosphere, Diffusion.

The direction observational evidence for the effect of the change of wind direction with height in producing crosswind dispersion of a plume of windborne material, besides that arising directly from the crosswind component of turbulence, is considered. Theoretical indications of the magnitude of horizontal spread resulting from the interaction between vertical diffusion and the wind profile are briefly reviewed. Assuming a fairly realistic form for the spectrum of turbulence the effect of this interaction is evaluated from a treatment by F. B. Smith, and this is combined with the theoretical growth arising directly from the

horizontal component of turbulence to give a total crosswind growth curve. Two series of field experiments on dispersion in stable conditions are examined, one in Sweden using an elevated source of smoke puffs, the other in the U.S.A. using a continuous ground release of a fluorescent tracer. Both indicate that distortion of the plume by the turning of the wind became significant beyond 2-3 km downwind, but that the immediate transference of the effect to enhance the spread at a given level was not important within about 5 km for the elevated source or about 12 km for the ground source. (Author abstract modified)
APTIC-23474

### THE BENT-OVER PLUME OF HOT GAS.

Quart. J. Roy. Meteorol. Soc. (London), vol. 83:269-270, 1957. 2 refs. (Includes a reply by C. H. B. Priestley.)
G. Spurr.
Identifiers: *Mathematical analyses, *Plume behavior, Great britain, Stacks.

The Priestley formulas for calculating the transition of a plume from a chimney stack are analyzed, and a cubic equation is shown to have practical advantages if the solutions can be tabulated over a useful range of independent variables. When the variables are more than two, a single table does not appear practical.
APTIC-23479

### CERTAIN ASPECTS OF THE STUDY OF AEROSOLS IN THE LOWER LAYERS OF THE TROPOSPHERE.

(Nekotoryye voprosy issledovaniya aerozoley v nizhnikh sloyakh troposfery). Text in Russian. Tr. Inst. Geofiz. Akad. Nauk Gruz. SSR, 25 (1):198-204, 1967. 4 refs.
A. Z. Makharashvili.
Identifiers: *Aerosols, *Lower atmosphere, *Inversion, Ussr, Urban areas, Air quality measurements, Dispersion.

Air-sample studies made over the city of Tbilisi are reported, and the following conclusions are drawn: 1) with normal atmospheric stratification, the aerosol distribution with height is exponential, while certain observed deviations are peculiarities of residual elements in the structure of the troposphere; and 2) short-term and, in particular, high inversion layers have practically no effect on the shape of the aerosol concentration curve as a function of height. Under these conditions, no noticeable increase in concentration of aerosol particles is observed in the subinversion layer. With near-ground inversion, an especially high concentration of aerosols in the subinversion zone is observed.
APTIC-23481

### COMPOSITION OF ATMOSPHERIC PRECIPITATION IN SWEDEN.

Tellus (Uppsala), 6 (3):261-267, Aug. 1954. 6 refs.
A. Emanuelsson, E. Eriksson, and H. Egner.
Identifiers: *Sweden, *Chemical composition, *Precipitation, Oceans, Mapping, Winds, Topographic interactions, Ammonium compounds, Chlorides, Calcium compounds, Potassium compounds, Sodium compounds, Nitrates, Nitrogen.

Preliminary charts are presented to demonstrate the geographic distribution over Sweden of the annual amounts of sodium, chlorine, calcium, potassium, ammonia-nitrogen, and nitrate-nitrogen brought to the surface of the earth by precipitation. The accumulated amounts of atmospheric precipitation were collected monthly at 28 places during the period Oct. 1, 1947 to Sept. 30, 1950. On another series of maps, the weight ratios of the different elements to sodium have been plotted and are represented by isolines. Comparisons are made between these ratios and the corresponding quantities in sea water. The highest amounts of sodium are on the freely exposed part of the west coast; inland, the amounts decrease roughly logarithmically with distance from the coast. There is a slight indication of a weak secondary maximum along the Baltic coast north of Stockholm, where northeasterly winds from time to time give rise to cyclonic-orographic precipitation from low-level clouds. Distribution of the yearly deposits of chloride is similar to that of sodium, as might be expected; the sea presumably is the only important source for both of these elements. The low weight ratio of Cl/Na at the coast and the further decrease inland certainly is of great geochemical interest, but reasons cited to explain this phenomenon are not conclusive. Yearly amounts of calcium are fairly uniform, decreasing somewhat to the north, while a high value in the south is due to local pollution from a cement factory. As the Ca/Na ratio in the sea is 0.038, the sea can hardly be any appreciable source for Ca in precipitation. There is a small but definite gradient for potassium from the west coast and a slight increase at the east coast north of Stockholm. As potassium in sea water is low (K/Na equal to 0.036), the sea cannot be the only prominent source although the gradient would so suggest. A ridge of high amounts of H3N-N is in the southwest where the influence of Denmark on the prevailing southwesterly winds over Sweden is very pronounced. The general pattern of isolines for NO3-N runs parallel to the coast. (Author abstract modified)
APTIC-23509

### VERTICAL DISTRIBUTION OF AEROSOLS AND AEROSOL LAYERS IN THE ATMOSPHERE.

(O vertikal'nom raspredelenii aerozolya i aerozol'nykh sloyakh v atmosfere). Text in Russian. Probl. Fiz. Atm., no. 5:206-214, 1967. 28 refs.
A. M. Bunakova, and L. S. Ivlev.
Identifiers: *Aerosols, *Scattering (atmospheric), Ussr, Particle size, Lower atmosphere.

Vertical concentration profiles up to 27 km are plotted, on the basis of available data, for particles larger than 0.1 micron, condensation nuclei, aerosols, and water vapor. The coefficient of scattering (sigma) of the atmosphere as a function of height up to 25 km is also plotted, and reveals a thin, weakly expressed aerosol layer at 11.5 plus or minus 1 km and a much stronger layer (sigma, about 0.0045 inverse km) at 19.5 plus or minus 1 km. No new work is reported.
APTIC-23513

### CHEMICAL COMPOSITION OF CLOUD WATER IN REGIONS OF WESTERN SIBERIA.

In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Vol. IV. Meteorological and Chemical Aspects of Air Pollution; Propagation and Dispersal of Air Pollutants in a Number of Areas in the Soviet Union. M. Y. Nuttonson (ed.), Silver Spring, Md., American Institute of Crop Ecology, 1970, p. 87-93. 4 refs. (Also: Tr. Gl. Geofiz. Observ. (Leningrad), no. 234:130-136, 1968.)
O. P. Petrenchuk.
Identifiers: *Clouds, *Precipitation, *Chemical composition, Ussr, Transport, Advection, Anticyclones, Cyclones (atmospheric), Winds, Temperature (atmospheric), Inversion, Ammonium compounds, Chlorides, Calcium compounds, Magnesium compounds, Potassium compounds, Sodium compounds, Nitrates, Sulfates, Ph.

The chemical composition of cloud water is examined on the basis of samples collected in the vicinity of Western Siberia. Conditions which can affect the content of precipitation include the chemical nature of the condensation nuclei, the amount of local pollution, and various meteorological parameters. Samples of water are obtained from clouds formed under anticyclonic and cyclonic conditions, in cases of slight advection and marked transport of air masses, and from precipitating frontal clouds. Temperature inversions are present in some cases. Measured species include sulfate ion, chloride, nitrate, ammonium, sodium, potassium, magnesium, calcium, and pH. The relative concentrations of these species and their probable sources and methods of transport are discussed.
APTIC-23524

### THE ATMOSPHERIC DIFFUSION OF GASES DISCHARGED FROM THE CHIMNEY OF THE HARWELL REACTOR BEPO.

Intern. J. Air. Pollution, vol. 1:87-102, 1958. 12 refs.
N. G. Stewart, H. J. Gale, and R. N. Crooks.
Identifiers: *Reactors (nuclear), *Plume behavior, *Diffusion, Great britain, Stack gases, Stacks, Ground level, Lower atmosphere, Winds, Temperature gradient, Turbulence (atmospheric), Radioactive tracers.

The 61 m chimney of the BEPO reactor at Harwell, England, discharges warm air containing a small amount of radioactive argon. This gas is used as a tracer to study the diffusion of the plume in the atmosphere downwind of the chimney. Surveys are carried out at ground level up to a distance of 10,000 m and, with instruments suspended from a balloon, up to a height of 300 m at a maximum range of 1000 m. The results are correlated with the gradient of potential temperature in the atmosphere near ground level. The effective height of the plume depends on the wind velocity u and on the temperature gradient, having a mean value of 125 m under adiabatic conditions when u equals 7 m/sec. The diffusion of the plume over the range studied occurs in three distinct phases. Near the chimney, the rate of vertical diffusion is about twice that in the horizontal direction as a result of the discharge conditions. As the plume diffuses towards ground level it enters a region dominated by building turbulence and the rate of diffusion in both directions is greatly increased. Finally, as it travels beyond the built-up area, the rate of diffusion reverts to that characteristic of diffusion over open country. Sutton's diffusion equations cannot be simply applied to this complex type of problem, but they provide a useful model for classifying the data, and effective values of virtual diffusion constants are derived for each stage of the diffusion process. Under statically stable conditions, no detectable concentrations were found on the ground within 10,000 m of the chimney. (Author abstract modified)
APTIC-23527

### VARIABILITY AND UPPER BOUNDS FOR MAXIMUM GROUND LEVEL CONCENTRATIONS.

Phil. Trans. Roy. Soc. London, Ser. A, 265 (1161): 209-220, Nov. 13, 1969. 9 refs.
R. A. Scriven.
Identifiers: *Ground level, *Diffusion models, *Plume behavior, Hourly, Great britain, Stack gases, Stacks, Winds.

The properties of the various factors which arise in the conventiona plume formula for maximum hourly mean ground level concentration (max. g.l.c.) after fixing mean wind speed and source strength are studied with a view to assessing variability and comparing with results from the Tilbury field trial. The analysis indicates some ambiguity in defining vertical spread for dispersion from tall stacks and suggests that the formula might be more profitably rearranged. A natural rearrangement is pointed out and this leads to a simple upper bound for max. g.l.c. in an unbounded atmosphere which is only 20% larger than the familiar result for a uniform atmosphere. This result is obtained using the diffusion equation with simple power laws for wind speed and eddy diffusivity. The general conservation equation is then considered and this leads to a specific definition of mean wind speed below source level and the indication of a general upper bound some 50% larger than the uniform atmosphere value, provided certain reasonable conditions are met. The practical implications of these results are discussed, and the extra effects introduced by stable layers are pointed out. (Author abstract modified)
APTIC-23529

### MEASUREMENTS OF ULTRAVIOLET RADIATION IN A POLLUTED ATMOSPHERE.

California Univ., Davis, Dept. of Agricultural
Engineering, PHS Grant 5 RD1 AP00742-02,
Scientific Rept. 1, 62p., Dec. 1969. 28 refs.
Kinsell L. Coulson.
Identifiers: *Polarization, *Ultraviolet radiation, Los angeles, Instrumentation, Mathematical modeling, Scattering (atmospheric), Light scattering.

As part of a study to determine the effects of air pollution on the ultraviolet radiation regime of the atmosphere, results from measurements of the relative intensity and degree of polarization of ultraviolet light over the hemisphere of the sunlit sky for the case of a polluted atmosphere in Los Angeles are shown and compared to similar data for a clear natural atmosphere, and to results computed for a pure Rayleigh atmospheric model. Instrumentation is described in detail, including a newly-developed polarizing multi-channel radiometer and ultraviolet flux meters. Pollution brings about an increase of skylight intensity over most of the sky by a factor of two or more, a pronounced decrease of intensity near the horizons, and a significant change of the intensity pattern over the sky hemisphere. For moderate and high sun elevations, the intensity decreases monotonically with increasing angle from the sun at all azimuths. The degree of polarization is decreased by a factor of more than two by pollution, but the polarization pattern is not greatly changed otherwise. The positions of the neutral points of skylight polarization in a polluted atmosphere are shifted from their measured positions in a clear atmosphere, the Babinet point being shifted by as much as 10 deg toward the sun and the Arago point by up to 8 deg toward the anti-sun by the effects of pollution. The position of the Babinet point is considered a relatively sensitive indicator of pollution. (Author abstract modified)
APTIC-23532

### ATMOSPHERIC STABILITY CRITERIA FOR DETERMINING THE EFFECTIVENESS OF AGENT RELEASES IN ESTABLISHING GROUND LEVEL CONTAMINATION.

Dugway Proving Ground, Utah, Cloud Diffusion
Branch, Proj. 4-98-05-026, DPGRR 111, 39p., Feb.
1957. DDC: AD 121704
William G. Tank.
Identifiers: *Ground level, *Plume behavior, *Temperature gradient, Settling particles, Mathematical analyses, Lower atmosphere, Winds, Clouds, Temperature (atmospheric).

The ability of an instantaneous release of agent to establish subsequent ground level contamination is dependent on the initial vertical displacement of the agent cloud. Equations are derived expressing the vertical velocity, w, experienced by a cloud immediately after explosive release. The form of the basic solution is such that the initial displacement of the cloud is dependent upon the vertical distribution of the potential temperature. Theoretical interpretations are verified by the analysis of test data showing both heavy and light ground level contamination. If a cloud is released or expelled above a layer in which the potential temperature decreases with height, no matter how shallow such a layer is, the cloud can never work back down through it. Therefore, if the above criteria are to be used as an aid to future test programs, the findings indicate that temperature measurements should be made at small height intervals from the surface upward to well above the expected vertical extent of the initial burst cloud. If the intervals between measurements are too great, important temperature fluctuations in the vertical may be completely masked. Such measurements should be made as close to the release point as possible. Similar measurements should be made along the trajectory of the cloud in order to determine whether a layer in which the potential temperature decreases with height appears downwind, thus effectively blocking further contamination, or whether any such existing layer is nullified, thus permitting the cloud to finally reach the surface. (Author abstract modified)
APTIC-23536

### PLANS FOR GLOBAL ATMOSPHERIC RESEARCH.

New Scientist, 47 (712):226-228, July 30, 1970.
Mike Baker.
Identifiers: *Research programs, *Altitude, *Meteorology, Area surveys, Survey methods, Meteorological instruments, Lower atmosphere, Middle atmosphere, Micrometeorology, Weather forecasting, Weather modification.

The International Council of Scientific Unions and the World Meteorological Organization have joined to sponsor a Global Atmospheric Research Program for the study of physical processes in the troposphere and stratosphere and of the factors determining the statistical properties of the general circulation of the atmosphere. Research into the physical processes could lead to increased accuracy in weather forecasting and research into the statistical properties of circulation, to a better understanding of the physical basis of climate. The first experiment planned for the program will take place in the tropics in the period 1973-1974. It will measure tropical disturbances on four characteristic scales: the large-wave scale (characteristic size of the order of 2000-10,000 km); the scale of cloud-dusters (characteristic size of the order of 100-1000 km); the meso-convective scale (characteristic size of the order of 10-100 km); and the scale of convective cells (characteristic size of the order of 1-10 km). The experiment will rely on a satellite-borne infrared sounder, a near-polar orbiting satellite, regional networks of upper air stations, a geostationary satellite, and at least 15 ships equipped for meteorological and oceanographic observations. The program may provide information relevant to the modification, or even control, of climate.
APTIC-23588

### DEUTERIUM CONTENT OF SNOW CORES FROM SIERRA NEVADA AREA.

Science, 169 (3944):467-470, July 31, 1970. 4 refs.
Irving Friedman, and George I. Smith.
Identifiers: *Deuterium, *Snow, Nevada, Mountains, Altitude, Lower atmosphere, Micrometeorology, Topographic interactions, Turbulence (atmospheric), Hydrogen, Isotopes.

Snow cores, representing a composite of the entire winter's accumulation of snow, were collected at 37 sites in the Sierra Nevada in April 1969 and analyzed for deuterium variations. For samples collected west of the Sierra Nevada divide, there was a clear inverse relationship between the deuterium concentration and the altitude of the collection. Samples collected at the lowest elevations had 75 per mil more deuterium than samples collected at the highest elevations. Samples collected from areas east of the divide suggested only a vague relationship between deuterium and altitude, but this result is attributed to additional turbulence created by air masses moving across the irregular Sierra Nevada crest. The turbulence destroyed the relatively systematic relationship between isotopic ratios and altitude indicated by samples from the west slope. The deuterium variations accurately reflected differences in concentration of moisture deposited on both slopes. The results indicate that the isotopic composition of snow cores will show variations that are useful in comparing the climate of one winter with that of other years.
APTIC-23589

### OPTICAL PROPERTIES OF THICK FOG LAYERS.

Tellus (Uppsala), 22 (3):321-327, 1970. 20 refs.
S. Pahor, and M. Gros.
Identifiers: *Mathematical analyses, *Fog, *Light scattering, Europe.

The reflection and transmission properties of thick, plane layers of fog, which is a highly anisotropically scattering medium, are investigated. The function describing the law of reflection for a semi-infinite plane layer is determined. A table based on the scattering function of Spencer is presented. With the help of this function, the angular distribution of the emerging light in the case of the Milne problem and the extrapolation length are computed. Finally, the angular distribution of the light reflected and transmitted by a thick layer of fog are expressed in terms of the R-function and of the angular distribution of the Milne property. (Author abstract modified)
APTIC-23590

### METEOROLOGICAL NOTES ON TRAVEL OF DEBRIS FROM AN ATOMIC EXPLOSION AT MURUROA ON 7 JULY 1968.

Meteorol. Mag. (London), vol. 99:165-170, 1970. 9
refs.
C. L. Hawson.
Identifiers: *Nuclear explosions, *Transport, *Fallout, Great britain, Ground level, Lower atmosphere, Winds.

The times of first detection of radioactive debris at the ground at Pretoria, Aspendale and Bombay following an atomic explosion at Mururoa on 7 July 1968 accord well with times and tracks inferred from charts of average upper winds over the world for July and their associated standard vector deviations. In particular, rapid interhemispheric interchange in the lower troposphere over the Indian Ocean is in agreement with recent studies by Findlater of the wind fields in that area. (Author summary)
APTIC-23598

### TRACERS IN THE AIR.

Weatherwise, 23 (4):182-185, Aug. 1970.
Alfred K. Blackadar, and John A. Dutton.
Identifiers: *Tracers, *Weather forecasting, Lower atmosphere, Winds, Temperature (atmospheric), Water, Vapors, Thermodynamics.

Modern methods of weather forecasting and atmospheric research are based on well-known quantitative physical laws that relate to what is usually called a 'parcel' of air. A parcel is a relatively small piece of identifiable air that maintains some sort of integrity as to moves around from point to point. Some useful ways to tag air parcels include the water vapor concentration, potential temperature, absolute vorticity, and potential vorticity. Since temperatures vary, one simply determines what the temperature of the selected parcel of air would be if it were lowered to some pressure like 1000 mb that is characteristically found near sea level. This potential temperature is not affected by vertical motion as long as the limitations observed in defining it (that is, no heat addition or removal) are experienced by the parcel. Entropy is uniquely related to potential temperature, and if we take all the air parcels in the atmosphere with a given value of potential temperature, they make up a wrinkled irregular surface generally known as an isentropic surface. Absolute vorticity, which is the earth's spin added to the spin of air, is a very conservative property in the middle troposphere, which has led to the barotropic prediction model now being used to forecast winds at these levels. Formed from vorticity and potential temperature, potential vorticity provides valuable clues to the processes at work in the atmosphere.
APTIC-23599

### COASTAL AIR-CIRCULATION SYSTEM: OBSERVATIONS AND EMPIRICAL MODEL.

Monthly Weather Rev., 98 (7):487-509, July 1970.
15 refs. (Presented at the American Geophysical
Union-American Meteorological Society Meeting,
Washington, D. C., April 24, 1969.)
Shih-Ang Hsu.
Identifiers: *Texas, *Sea breeze, Computers, Mathematical analyses, Mathematical modeling, Meteorological instruments, Humidity, Pressure (atmospheric), Temperature (atmospheric).

On the basis of observations obtained from 1965 through 1967, an empirical model in space and time of the Texas coast sea breeze system has been synthesized. Instrumentation included the hygrothermograph, thermograph, microbarograph, surface wind set, pilot balloon (theodolite set), radiosonde, and aircraft. The parameters measured directly were temperature, pressure, relative humidity, and wind. A CDC 6600 computer was used to calculate dew point temperature; geopotential height; and onshore, offshore, and along-the-shore wind components for perpendicular and parallel to the coast vertical cross sectional analyses. A study of the surface temperature field associated with the upper wind field was necessary to establish the concept that the sea breeze is a mesoscale thermally driven circulation. The land and sea breeze effect across the Texas coast could be explained by means of the solenoid field. From the pibal and theosonde observations, the upper air wind field was analyzed and a complete life cycle of the Texas coast sea breeze could be studied. Further evidence of the Coriolis effect on the Texas coast sea breeze was shown, and alongshore variations of the sea breeze are indicated. The synthesized model is also compared to a theoretical three-dimensional numerical model.
APTIC-23602

### THE ORIGIN OF NITRIC OXIDE IN THE TERRESTRIAL ATMOSPHERE.

Planetary Space Sci., 18 (7):1111-1118, July 1970. 32 refs.
M. Nicolet.
Identifiers: *Upper atmosphere, *Nitric oxide (no), *Photochemical reactions, Belgium, Middle atmosphere, Diffusion, Transport, Nitric acid, Nitrogen, Nitrogen dioxide (no2), Dissociation, Reaction mechanisms.

Recent observations in the stratosphere, mesosphere, and thermosphere indicate that nitric oxide is present in significant amounts, even though its local production seems to be very small. Reactions which might account for an indirect way of production are discussed. Nitric oxide in the stratosphere and mesosphere may be due to downward transport from the thermosphere. Photochemical reactions, including photodissociation, are described. Balances of reactions of formation and removal of nitric oxide and atomic nitrogen are considered. In the lower thermosphere, the downward current of NO molecules depends on the value of the eddy diffusion coefficient. In the stratosphere, the final sink of NO and NO2 is the formation of HNO2 and HNO3 by reactions with HO2 and H202. A small eddy diffusion coefficient is required.
APTIC-23604

### FOUL VAPOURS: PART 1.

Sciences, 10 (4):5-8, April 1970.
Personal Author Not Recorded.
Identifiers: *Molecular states, *Photochemical reactions, Proteins, Carcinogens, Health impairment, Automotive emissions, Smog, Quenching, Oxygen, Vapors.

In the presence of nitrogen oxides and hydrocarbons from automobile exhaust, oxygen is photochemically excited to a singlet molecular state. Singlet molecular oxygen has adverse effects on proteins, may be photocarcinogenic, and may play a role in the hereditary disease called porphyria. Efficient SMO production by the quenching of electronically excited states of organic molecules has been well documented; highly metastable singlet oxygen is relatively reactive at ordinary temperatures and may be the oxidant in all sensitized photooxidation reactions. A multidisciplinary approach to the biological effects of singlet oxygen in photochemical smog is now underway at the University of California in Riverside.
APTIC-23613

### EVAPORATION OF CONTAMINATED AND PURE WATER DROPLETS IN A WIND TUNNEL.

J. Atmospheric Sci., 27 (6):914-918, Sept. 1970. 16 refs.
Thomas E. Hoffer, and Steven C. Mallen.
Identifiers: *Evaporation, *Droplets, Engine exhausts, Ventilation, Mathematical analyses, Testing facilities, Diffusion, Clouds, Fog, Heat transfer.

Experiments relative to fog and cloud droplet evaporation under contaminated conditions are reported. Since the droplet is supported in a wind tunnel, the effects of ventilation, heat exchange and circulation within the drop are incorporated into the experimental observations. Relative humidities were substantially below saturation. Evaporation of the pure water droplets followed, within experimental limits, the diffusional growth equation. However, all contaminated droplets tended to evaporate more slowly than would be computed theoretically. Two of the contaminated samples were derived by bubbling exhaust from a gasoline engine through water, while another type of contamination was studied wherein already generated droplets passed through an aerosol cloud of hexadeconal.
APTIC-23614

### AIRBORNE OBSERVATIONS OF CONTRAIL EFFECTS ON THE THERMAL RADIATION BUDGET.

J. Atmospheric Sci., 27 (6):937-942, Sept. 1970. 8 refs.
Peter M. Kuhn.
Identifiers: *Contrail sheets, *Jet aircraft, *Weather modification, *Thermal radiation, Radiation measuring systems, Mathematical analyses, Temperature (atmospheric), Scattering (atmospheric), Infrared radiation, Solar radiation.

Direct infrared and solar radiometric observations were made to analyze the effects on the environment of any alterations in the radiation budget in regions of heavy jet traffic. The observations, made from the NASA Convair 990 jet laboratory, were coupled with Mie scattering and absorption theory calculations to analyze any inadvertent alterations in the natural atmospheric thermal radiation budget. The particle concentration of contrail sheets composed of assumed monodispersed equivalent hollow spherical ice particles, derived from radiometric theory, is consistent with a derivation of the same quantity from in situ radiometric observations of contrails. A 500 m thick contrail sheet increased the infrared emission below the sheet by 21% but decreased the solar power below the sheet by 15%. The infrared increase cannot make up for the solar depletion, resulting in a net available incoming power depletion at the base of the sheet of 12%. Such a change results in a 7% reduction in the net total available thermal power at the earth's surface, which results in a 5.3 C decrease in the surface temperature, if we assume contrail persistence. The actual temperature decrease is approximately 0.15 C with 5% contrail persistence. (Author abstract modified)
APTIC-23617

### THE EXTENSION OF AIR POLLUTION FROM LAND OVER OCEAN AS REVEALED IN THE VARIATION OF ATMOSPHERIC ELECTRIC CONDUCTIVITY.

J. Meteorol. Soc. Japan, 48 (4):263-269, Aug. 1970. 9 refs.
M. Misaki, and T. Takeuti.
Identifiers: *Oceans, *Electroconductivity analyzers, *Electricity (atmospheric), Japan, Diffusion.

In October 1966, measurements of atmospheric electric field intensity and conductivity were made aboard the antarctic observation ship 'Fuji' during her test cruise around the Japan Islands. The Gerdien apparatus for measurements of electrical conductivity was placed on the flag deck about 14 m above the sea surface, while a portable field-mill developed at Kyoto University was placed on a pole which was about 2 m higher than the flag deck. Atmospheric electric conductivity over the ocean varied with distance from land. Based on the concept that the atmospheric pollution originating on the land and extending over the sea by diffusion reduces the small ion concentration, the rate of increase in electric conductivity with distance from land is considered to represent the rate of decrease in atmospheric pollution. The conductivity remained almost constant over the sea which is a certain distance away from the land, being 1.35 times 10 to the minus 14th power mho/m.
APTIC-23618

### AUTO EXHAUST, POLLUTION AND WEATHER PATTERNS.

Bull. At. Sci., 26 (8):31-33, Oct. 1970.
Vincent J. Schaefer.
Identifiers: *Automotive emissions, *Haze, Combustion gases, Particulates, Jet aircraft, Vehicles, Particle size, Precipitation, Rain, Snow, Weather modification, Hydrocarbons, Lead compounds, Carbon dioxide, Carbon monoxide, Nitrogen oxides, Nucleation, Particle growth, Ice.

Most of the pollution comes from effluents which consist of invisible particulate matter and accompanying vaporous gases which cannot be seen when they are released into the atmosphere. If one looks at the air along a freeway or other heavily traveled road, very little if any exhaust smoke can be seen coming from the traffic, while going through a long vehicular tunnel, a bluish haze will be seen in the air and if the windows are open a foul smell can be noted. Such air contains tremendous numbers of small particles as well as gases of combustion, particularly carbon monoxide, carbon dioxide, the nitrogen oxides and hydrocarbons. While carbon particles are essentially inert, they can serve as frameworks on which gases adsorb and other liquids and solids agglomerate. When converting visible particles to invisible sizes, the residence time of such particles is greatly extended, and some of the natural nitrogen in the air is oxidized to produce nitrogen oxides. Hazards of the supersonic transport are cited, as well as inadvertent weather modification. A potent source of ice nuclei appears to be found in air polluted with automobile exhaust from leaded gasoline. Submicroscopic lead compounds probably react with small quantities of iodine vapor to form lead iodide. High concentrations of ice nuclei may stabilize clouds containing low amounts of liquid cloud water and thus reduce or prevent precipitation; on the other hand, if a rich source of moisture moved into a region and entrained extensive areas of polluted air containing many potential ice nuclei, it could produce excessive amounts of snow or rain.
APTIC-23620

### SOLAR RADIATION AND ABSORPTION IN POLLUTED ATMOSPHERES (SOLAROGRAPHIC MEASUREMENTS).

(Le rayonnement solaire et son absorption par les atmospheres polluees (Mesures solarigraphiques). Text in French. Cooperation Mediterraneenne Energie Solaire Bull., no. 10:48-51, July 1966.
W. Diamant.
Identifiers: *Solar radiation, *Particulates, *Absorption, France, Particle size, Diffusion, Ions, Particle growth.

A review of the physical properties and quantities effecting solar radiation is given. There is a strict relationship between concentration of pollutants in the atmosphere and absorption of solar radiation. Absorption of light is also related to diffusion. Polluting particles intercept the light and diffuse it; this is comparable to a filtering action with a resulting strong reduction of sunlight. Radius of the particles and light wavelength are interrelated. Bigger particles tend to absorb light more than diffuse it. At low altitudes, optical properties of air depend on small ions present in the atmosphere.

Clean air contains approximately 700 ions per cubic cm. Polluted air contains approximately 200 ions per cubic cm. However, big ions are found due to fixation of small ions on solid or liquid polluting particles. These big ions are the main cause of turbidity and reduction of intensity of solar radiation. Measurements of solar radiation have been conducted with a solarigraph.
APTIC-23623

### OXIDATION OF SULFUR DIOXIDE IN POLLUTED ATMOSPHERES.

Preprint, National Air Pollution Control
Administration, Cincinnati, Ohio, Div. of
Chemistry and Physics, 80p., 1970 (*). 85 refs.
Marijon Bufalini.
Identifiers: *Nitrogen oxides, *Sulfur dioxide, *Photooxidation, Stack gases, Oxidants, Aerosols, Droplets, Hydrocarbons, Carbon monoxide, Oxidation, Solar radiation, Nucleation, Gases, Water, Vapors, Reaction mechanisms.

Oxidation reactions of sulfur dioxide in polluted atmospheres are discussed. Emphasis is on the photochemical reactions of sulfur dioxide in the wavelength range of 3000 to 4000 A alone and in mixtures with nitrogen oxides and/or hydrocarbons or carbon monoxide. Reactions of sulfur dioxide in the presence of foreign particles on nuclei and reactions of sulfur dioxide with metal salt solutions and droplets are also discussed. The gas-phase reactions, the formation and chemical identity of aerosols, the effect of water vapor, the effect of nucleating particles on photochemical aerosol formation, and the effect of sulfur dioxide on nitrogen oxides - hydrocarbon reaction parameters are included. (Author abstract modified)
APTIC-23631

### ATMOSPHERIC DUST RECORDS IN GLACIAL SNOWFIELDS: IMPLICATIONS TO MARINE SEDIMENTATION.

California Univ., San Diego, Thesis (Ph.D.), Ann
Arbor, Mich., Univ. Microfilms, Inc., 1968, 105p.
53 refs.
Herbert Lynn Windom.
Identifiers: *Oceans, *Build-up rates, *Dust fall, *Snow, Chemical composition, Particle size, Tracers, Transport, Winds, Lead compounds, Isotopes.

Contributions of atmospherically transported solids to marine sediments were considered by an investigation of the dust accumulation in glacial snowfields. Seven snowfields, including the Antarctic and Greenland ice sheets and five associated with temperate glaciers, were studied. Lead-210 geochronology was used to ascertain rates of snow accumulation and of dust fallout, while semiquantitative mineralogical and size analyses were carried out on the particulate matter in the ice samples. Results indicate that the dust comes from material derived from local and distant (global) sources. Composition of the global component is dependent on sources under its wind system, while that of the local component is dependent on the regional geology and physiography of the sampling area. The accumulation rates of the global dust component range from 0.1 to about 1.0 mm per 1000 years. Comparison of the accumulation rate, mineralogy, and size distribution of the globally transported dusts with those of the adjacent marine sediments of the North and South Pacific and Central Atlantic oceans, suggests that these areas receive as much as 25-75% of their detrital phases from atmospheric dust fallout. (Author abstract)
APTIC-23646

### REPORT ON METEOROLOGICAL EFFECTS ON ATMOSPHERIC SAMPLING.

North American Weather Consultants, Goleta,
Calif., 80p., July 1958. 18 refs.
Frederic A. Berry, and Sidney R. Frank.
Identifiers: *Sampling methods, *Coning, *Fumigation, *Tracers, Stacks, Neutron activation analysis, Winds, Temperature (atmospheric), Topographic interactions.

Meteorological and source parameters governing the rate of dilution of stack effluent are reviewed, and a tracer sampling program is developed for analyzing coning and fumigation type plumes. The minimum requirements for such a program consist of visual observations of the plumes, a continuous record of wind speed at height of stack top, a continuous record of wind direction at height of stack top, and representative air temperatures. Suitable meteorological conditions for sampling are noted, as are proper sampling locations and sampling time intervals. The processing and recording of meteorological data are described, and the importance of weather forecasts of wind direction and speed to the sampling program are emphasized. Methods of computing maximum distance to which a quantity of tracer material can be detected, plume at azimuth, predicted concentration patterns, and the effect of terrain on concentration are discussed. Detailed instructions are given for plotting and analyzing data. The analytical procedure is illustrated by application to measured concentration data obtained in a stack gas study involving neutron activation analysis.
APTIC-23648

### HANDBOOK FOR ESTIMATING TOXIC FUEL HAZARDS. (FINAL REPORT).

GCA Corp., Bedford, Mass., Technology Div.,
Contract NAS8-21453, Rept. CR-61326, 490p.,
April 1970. 15 refs. CFSTI: N70 30506
R. K. Dumbauld, J. R. Bjorklund, H. E. Cramer,
and F. A. Record.
Identifiers: *Fuels, *Missiles and rockets, *Air pollution forecasting, *Diffusion models, Deposition, Florida, Fuel evaporation, Computer programs, Ground level, Winds, Clouds, Humidity, Precipitation, Inversion, Temperature gradient, Turbulence (atmospheric).

A complete documentation of the computerized and graphical procedures for estimating toxic fuel hazards at Kennedy Space Center is presented. A detailed description of the generalized diffusion models and the meteorological data used to develope these procedures is given. The procedures outlined are applicable both to planning and research studies and to real-time operational problems. The computerized multilayer diffusion construct forms the basic framework for calculating concentration, dosage, and deposition fields associated with the emission of toxic materials from normal and abnormal launches, vehicle destructs, fuel leaks and spills, and other operations at Kennedy Space Center. The meteorological parameters considered include wind and temperature profiles, humidity, inversions, turbulence, precipitation, deposition, and cloud cover. The graphs, nomograms, and tables included permit the rapid manual estimation of ground level concentration and dosage fields for selected sources and simplified atmospheric conditions.
APTIC-23649

### VERTICAL-ATTENUATION MODEL WITH EIGHT SURFACE METEOROLOGICAL RANGES 2 TO 13 KILOMETERS.

Air Force Cambridge Research Labs., Bedford,
Mass., Optical Physics Lab., OAR Proj. 7621-08-
01, DOD Element 62101F, Subelement 681000,
Rept. AFCRL-70-0200, Environmental Research
Paper 318, 72p., March 1970. 17 refs. CFSTI,
DDC: AD 707488
Louis Elterman.
Identifiers: *Visibility, *Haze, *Attenuation, Aerosols, Mathematical modeling, Ground level, Lower atmosphere, Ozone, Infrared radiation, Ultraviolet radiation, Visible radiation.

An examination of the haze regime shows that the aerosol properties of a surface meteorological range generally affect a mixing layer to 5 km altitude, and the lower and upper visibility limits of a haze regime are defined by meteorological ranges 1.2 km and 15 km, respectively. Within these limits, eight meteorological ranges are selected for developing ultraviolet, visible, and infrared aerosol attenuation coefficients. An aerosol scale height is derived for each meteorological range. Finally, the computed aerosol attenuation coefficients are presented as tabulations, which include previously published attenuation parameters (aerosols, molecules, and ozone) to 50 km altitude. (Author abstract)
APTIC-23650

### DETERMINATION OF THE TROPOSPHERIC RESIDENCE TIME OF LEAD-210.

Science, vol. 137:994-995, Sept. 21, 1962. 6 refs.
L. M. Fry, and K. K. Menon.
Identifiers: *Lower atmosphere, *Lead compounds, *Isotopes, Rain, Bismuth compounds.

The activity ratios of polonium-210 to lead-210 and the ratios of bismuth-210 to Pb-210 in rains can be used to calculate tropospheric residence times. Pb-210 was isolated by the addition of an inactive lead carrier to rain samples, while Bi-210 with added inactive bismuth carrier was successively precipitated as oxychloride, dimethylglyoximate, and phosphate. The gas-flow CE-14 Traceriab counter used in this work employed an aluminized Mylar window 0.9 mg/sq cm thick and had a low background of 1.0 count/min. If experimentally obtained Pb-210/Bi-210 activity ratios are used to solve for the fallout constant, it is indicated that the tropospheric residence time of Pb-210 is of the order of 1 week, although individual values fluctuated. The mean interval between two rainfalls in the Fayetteville, Arkansas region was calculated for Nov. 1958 through Aug. 1961. There were 171 precipitations in 1029 days, with the average interval between two rainfalls being 6.0 days. The mean tropospheric residence time of Pb-210 is in excellent agreement with the mean interval of 6 days between two successive rainfalls in this area.
APTIC-23659

### PREDICTIONS OF THE TERMINAL ALTITUDE AND SIZE OF LARGE BUOYANT CLOUDS GENERATED BY ROCKET LAUNCHES.

Aerospace Corp., El Segundo, Calif., Fluid
Mechanics Dept., Space and Missile Systems
Organization Contract F04701-69-C-0066,
SAMSO-TR-70-207, Aerospace-TR-0066 (5115-
10)-1, 56p., May 1, 1970. 17 refs. CFSTI, DDC:
AD 707110
William S. Hart.
Identifiers: *Missles and rockets, *Diffusion models, *Plume behavior, Missiles and rockets, Mathematical modeling, Air pollution forecasting, Ground level, Lower atmosphere, Clouds, Temperature (atmospheric), Inversion, Temperature gradient.

An investigation to determine the dynamic characteristics of the low altitude clouds that are formed during the launch of large solid rocket motor boosters is presented. Motion pictures of launches of Titan III solid rocket motors were used, in conjunction with conservation equations and knowledge of rocket plume properties, to determine the initial temperature and mass of the large cloud that is generated during these launches. These initial conditions were applied to a mathematical model which accounted for buoyancy, drag, and entrainment. The model predicted the radius, altitude, temperature, and mass of the cloud as a function of time. The results showed fair agreement with size and altitude data extracted from the movies. This methodology was applied with limited success to smaller scale rocket clouds generated at test stands. The model was also used to predict the behavior of large exhaust clouds under various external temperature profiles. There is some experimental evidence that the model correctly accounts for unstable profiles, and the predictions of cloud rise during inversion conditions agree with what intuition would predict. (Author abstract modified)
APTIC-23677

### LIDAR OBSERVATIONS OF THE LOWER TROPOSPHERE DURING BOMEX.

Preprint, American Meteorological Society, World Meterological Organization, Geneva
(Switzerland), 6p., 1970, 5 refs. (Presented at the American Meteorological Society/World
Meteorological Organization, Symposium on Tropical Meteorology, Honolulu, Hawaii, June 2-11, 1970.)
Warren B. Johnson, and Edward E. Uthe.
Identifiers: *Lidar (laser radar), *Aerosols, *Lower atmosphere, Oceans, Lasers, Cameras, Transport, Advection, Clouds, Haze, Humidity, Scattering (atmospheric), Topographic interactions, Light scattering, Particle growth.

One segment of the Barbados Oceanographic and Meteorological Experiment (BOMEX) was conducted to provide information on both vertical and horizontal aerosol distributions that may reveal aerosol sources, sinks, transport and scavenging mechanisms. The lidar (laser radar) and associated instrumentation for this segment were installed in a USAF WC-130B aircraft near the left paratrooper door, which was opened in flight during the observation period to permit viewing at elevation angles from about +30 to -60 deg. A neodymium laser head was employed, yielding a peak power output of 50 MW and a pulse repetition rate of 18 pulses/min, while data were recorded on an oscilloscope equipped with a Polaroid camera and a trace shift mechanism so that five lidar traces could be placed on each photographic print. Typically, there are two stable regions in the lower atmosphere in the North Atlantic tradewind region that may inhibit the vertical transport of heat, momentum, moisture, and aerosols. Above the well-mixed subcloud region is a stable layer at heights of around 500 to 800 m; capping the cloud layer is the trade-wind inversion at heights of 2000 to 3000 m and with a thickness of perhaps 100 to 300 m. Since haze droplets grow larger with increasing humidity, the scattering observed by lidar is a function of humidity as well as aerosol number density. Aerosols and moisture may be transported into the lower atmosphere either from the sea surface, from the upper troposphere, or from other regions by horizontal advection.
APTIC-23691

### ON THE LABORATORY SIMULATION OF SMALL-SCALE ATMOSPHERIC TURBULENCE.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.,
AEC Contract AC (30-1)-4038, CAL Rept. VC-2740-S-1, 63p., Dec. 1969. 30 refs. CFSTI: NYO-4038-1
G. R. Ludwig, and T. R. Sundaram.
Identifiers: *Simulation, *Turbulence (atmospheric), Ground level, Lower atmosphere, Flow rates.

The results of an analytical and experimental program designed to study the degree of simulation of small scale atmospheric turbulence near the ground which can be attained in the laboratory are presented. Theoretical studies are performed to determine the degree of simulation of the atmospheric surface layer which is required to obtain meaningful results. An experimental study of the mechanical ability to generate a laboratory flow which meets the theoretical requirements is performed. The results are limited to consideration of the neutrally stable atmosphere. The flow properties investigated were vertical distributions of mean velocity, turbulent shear stress, and longitudinal and vertical turbulence intensity. Spectra of the longitudinal and vertical turbulence intensities were also obtained at selected heights above the rough ground. These data were compared to data obtained in a boundary layer generated naturally (no fence) over the same rough ground and to measurements made in the neutrally stable atmosphere where possible. Fence generated flow could be 'matched' to the rough ground by proper choice of fence height so as to provide a region near the ground of nearly constant shear stress which was three to four times as thick as that in a natural boundary layer, and which did not change measurably with distance downstream. In regions where both the natural and artifical boundary layers exhibited nearly constant shear stress, the remaining properties of the natural and artificial flow exhibited similarity. Comparison of the turbulence intensities and spectra of the turbulence intensities for the fence generated flow with atmospheric data showed relatively good agreement in the constant shear stress region. The roughness length derived from the mean velocity profile showed an increase of approximately thirty percent in a distance of about nine times the depth of the constant stress region. This variation is felt to be acceptable for modeling purposes in view of the difficulty in obtaining accurate estimates of roughness length for atmospheric flows. It is concluded that the experimental results obtained during the current program show that the fence-rough-ground combination provides a turbulent flow which appears superior to a naturally developed boundary layer for simulating turbulence in the lower atmosphere.
APTIC-23699

### SOME VARIABLE-PARAMETER, STEADY-STATE DIFFUSION RESULTS.

Pacific Missile Range, Point Mugu, Calif.,
Operations Research Group, PMR-TM-67-3, 60p., June 9, 1967. 11 refs. CFSTI, DDC: AD 815625
C. J. Thorne, and R. W. Claassen.
Identifiers: *Air pollution forecasting, *Diffusion models, Deposition, Computer programs, Altitude, Winds, Temperature (atmospheric), Stability (atmospheric).

The prediction of the concentration of toxic materials in the atmosphere, even from idealized analytical models, is a very difficult mathematical problem. Although important and useful results have been obtained from such models, the much more difficult problem with actual meteorological measurements remains untouched. A mathematical diffusion model which accurately reflects the meteorological data and appropriate methods of solution is presented. The meteorological parameters of wind, stability, altitude, and temperature are considered. The solution is given to a two-dimensional problem which includes absorption of the materials into a horizontal plane. The importance of the absorption or deposition of material on land or sea on the concentration at some distance from the source is verified in the variable-coefficient case. Constant-concentration isopleths are given for certain representative practical situations using actual meteorological data and an assumed formula for the dependence of the diffusion coefficient on these meteorological data. The resultant computer program can be used with a more accurate diffusion-coefficient formula when it is available. Further study is desirable to eliminate the slow convergence for large values of x (concentration at a large horizontal distance from the source) in the numeric solution and to verify the mathematical properties assumed in arriving at the analytical solution. The analytical solution should be put in a form for programming, and studies should be undertaken, both experimental and theoretical, to obtain an accurate relation between the diffusion coefficient and the appropriate meteorological parameters. Linear segment fitting is especially helpful in the solution, and application of this technique to other types of mathematical physics problems is also indicated. (Author abstract modified)
APTIC-23704

### ATMOSPHERIC OZONE.

J. Geophys. Res., 67 (5):1867-1875, May 1962. 8 refs.
John L. Kroening, and Edward P. Ney.
Identifiers: *Ground level, *Transport, *Ozone, Diurnal, Seasonal, Adsorption, Ozonesondes, Altitude, Lower atmosphere, Middle atmosphere, Diffusion, Thunderstorms, Inversion, Decomposition.

Ozone detectors of the chemiluminescent type were used for measuring ground-level ozone and the vertical distribution of ozone. They have been flown on several rasonde flights to pressures of 6 millibars, or 113,000 ft. Ground measurements show a strong diurnal variation coincident with the formation of a temperature inversion. Adsorption, storage, and desorption of ozone at the earth's surface are discussed, along with decomposition. The strength of the ozone sink at the earth's surface is approximately 6 times 10 to the 10th power atoms of ozone per sq cm per sec. A latitudinal and seasonal variation in the sink strength at the earth's surface is suggested in relation to the latitudinal and seasonal variation of total ozone. The vertical diffusive transport of ozone is considered, and evidence is given for the direct transport of air between the stratosphere and the troposphere via thin stable laminae. Data are presented indicating that the tropopause is not a barrier to the direct exchange of matter between troposphere and stratosphere. An explanation for the occurrence of secondary ozone maxima in the stratosphere is given. The production of ozone by lightning is calculated to be of the same order of magnitude as that produced by solar ultraviolet light. It is calculated that the ozone produced by a 50 megaton nuclear device amounts to about 0.1% of the total ozone in the atmosphere. (Author abstract modified)
APTIC-23714

### METEOROLOGICAL EFFECTS ON CALIFORNIA AIR POLLUTION.

Biometeorol. Proc. 3rd Int. Biometeorol. Congr., 1963, 2 (2):628-640. 13 refs. (Sept. 1-7.)
G. G. Bell.
Identifiers: *California, *Meteorology, *Carbon monoxide, Diurnal, Seasonal, Synergism, Urban areas, Automotive emissions, Oxidants, Smog, Natural gas, Fuel oils, Electric power production, Vehicles, Statistical analyses, Winds, Sea breeze, Condensation (atmospheric), Humidity, Precipitation, Pressure (atmospheric), Temperature (atmospheric), Stability (atmospheric), Inversion, Topographic interactions, Solar radiation.

Urban pollution experience in California arises from synergistic interaction of contaminants from a petroleum economy and certain features of a maritime coastal climate. The meteorologic effects of persistent inversions and a fugitive sea breeze coupled with pollution from extensive usage of motor vehicles produce episodic physiological strain on the urban population. Temporal changes in the avaiable atmospheric mixing volume in concert with strong topographic influences and contrasting temperature effects on natural ventilation produce a variety of influences on primary and secondary pollution. Diurnal variation in carbon monoxide concentrations is related to changes in both motor vehicle traffic and atmospheric stability, while a seasonal variation is a function of the consumption of natural gas and fuel oil for heating and power production. Seasonal meteorological variations combine during the summer to maximize the photochemical creation of oxidants, while increased atmospheric stability during cold, rainless winters results in the occurrence of highest maximum concentrations of CO during pollution episodes. Reactions, physical properties, and emissions of atmospheric contaminants undergo substantial changes depending on the state of the atmospheric environment. Humidity, solar energy horizontal ventilation, inversion height, and cloud cover play important parts in these respects. Statistical studies of historical data on pollutant concentrations and meterological variates show a general upward trend for carbon monoxide and oxidants for 1955-1963. (Author abstract modified)
APTIC-23723

### LEAD PARTICULATE MATTER IN THE ENVIRONMENT.

Preprint, Air Pollution Control Association, New York City, 20p., 1969. 15 refs. (Presented at the

Air Pollution Control Association Annual
Meeting, 62nd, New York, June 22-26, 1969, Paper 69-61.)
Patrick R. Atkins.
Identifiers: *Air quality measurements, *Lead compounds, Air quality standards, Highways, Residential areas, Engine exhausts, Aerosols, Droplets, Automobiles, Dust fall, Sedimentation, Dispersion, Rain, Tetraethyl lead, Nucleation, Particle growth.

The American Industrial Hygiene Association recently recommended a tentative Air Quality Value for lead of 10 micrograms/cu m of air averaged over thirty days. The increasing volume of high speed, high-density traffic in urban and suburban expressways produces large quantities of lead particulate matter in populated areas; but certain atmospheric cleansing processes appear to be capable of reducing the airborne lead concentrations below the recommended limits in most cases. The effectiveness of dispersion, sedimentation, and raindrop scavenging was observed by determining the lead content of air, dry fallout, and rainfall samples at three sites in a suburban community served by one major expressway. The results suggest that sedimentation and raindrop scavenging may remove large quantities of lead particulate matter. Dry fallout levels of one milligram of lead per square foot per week were common near the expressway, and lead concentrations in excess of 0.2 mg/l were observed in rainfall. These values were considerably reduced at the sites located several miles from the heavy traffic. Since the lead pollutants re believed to be exhausted from automobiles in the form of submicronic inorganic particles too small to be affected by sedimentation and scavenging, some growth process must occur. Nucleation and droplet growth may occur on the lead particles in the exhaust stream, producing aerosol particles which may coalesce rapidly or impact on the larger dust and combustion product particles present in areas of heavy traffic. (Author abstract modified)
APTIC-23743

### STUDY OF CRITICAL ENVIRONMENTAL PROBLEMS (SCEP). SUMMARY OF MAJOR FINDINGS AND RECOMMENDATIONS.

Preprint, 17p., July 31, 1970.
Personal Author Not Recorded.
Identifiers: *Water pollution, *Weather modification, Crops, Animals, Toxicity, Oceans, Particulates, Pesticides, Fuels, Fertilizing, Jet aircraft, Middle atmosphere, Clouds, Temperature (atmospheric), Mercury compounds, Carbon dioxide.

The results of a study of environmental problems the cumulative effects of which are so large and prevalent on ecological systems that they have world-wide significance are reported. Of primary concern are the indirect effects of pollution on man through changes in climate, ocean ecology, or in large terrestrial ecosystems. Several specific problems are considered, and recommendations to solve them are given. The combustion of fossil fuels increases the total supply of carbon dioxide. Direct climate change in this century resulting from CO2 is small, but the long term potential consequences are grave. Particulates in the atmosphere change the heat balance of the earth. These particles can be released naturally or from man-made sources. The effects of jet planes in the stratosphere, particularly in terms of cloud formation and temperature rise, are discussed. The effects of toxic pesticides on crops and complex ecosystems are studied. The concentration of these pesticides in marine organisms is a very serious problem. Mercury and other toxic heavy metals enter the environment through industrial processes and biocides. The effects of oil spills on the ocean are discussed. The eutrophication of waters through extensive use of nitrogen and phosphorus fertilizers leads to oxygen depletion and fish-kills. The amelioration of the massive environmental problems that exist depends upon social and political changes in the society.
APTIC-23744

### THE SIZE DISTRIBUTION AND AGING OF NATURAL AEROSOLS AS DETERMINED FROM ELECTRICAL AND OPTICAL DATA ON THE ATMOSPHERE.

J. Meteorol., vol. 12:13-25, Feb. 1955. 31 refs.
Christian Junge.
Identifiers: *Aerosols, *Particle size, *Mathematical analyses, Aitken counters, Diffusion, Haze, Brownian movement, Ions, Particle growth, Electric charge.

A first attempt at surveying the complete size distribution of natural aerosol particles is made. The size range covers more than three orders of magnitude in radius, with approximate limits of 0.002 and 5 times 10 to the minus 7th power cm. Previously only parts of this spectrum had been carefully investigated, due to the size limits of the various experimental methods used. Particle spectra down to radii below 0.0001 are well known, having been obtained by direct count under the microscope. Particles of radius less than 0.00001 are counted in the Aitken counter, but their size distributions can be determined only from mobility measurements on those particles which are charged. However, to deduce nuclei spectra from ion spectra, the fraction of charged particles must be known. Previous determinations of this fraction are examined and contain inaccuracies or errors. The expression derived here theoretically is used to convert some of the ion-spectra data into nuclei spectra. The particle-size range between radii of 0.00001 and 0.0001 cm has hardly been investigated because of the experimental difficulties encountered. Valuable information can be gained from the dependence of haze scattering on wavelength. The available data seem to indicate that the maximum number concentration is located between 0.00001 and 0.0001 cm radius, and that the number concentration drops to zero between 0.000001 cm and 10 to the minus 7th power cm. The size range greater than 0.00001 cm are well represented by a power law which seems to hold for large parts of the world. Based on data on ion and nuclei counts, it is further shown that the average radius of all particles increases when the total number decreases. This is explained by coagulation processes. (Author abstract modified)
APTIC-23749

### SULFUR DIOXIDE EMISSIONS.

(Schwefeldioxydemissionen). Text in German.
Staub (Duesseldorf), 21 (2):71-77, Feb. 1961. 29 refs.
Karl Schwarz.
Identifiers: *Stacks, *Dispersion, *Sulfur dioxide, Costs, Germany, Industrial areas, Stack gases, Coal, Fuel oils, Electric power production, Build-up rates, Dissipation rates, Sampling methods, Gas sampling, Source sampling, Stack sampling, Sulfur oxides control, Desulfurization of fuels, So2 removal (combustion products), Inversion.

The number and location of air sampling sites needed to establish the sulfur dioxide emission pattern and level of an individual enterprise, the pattern of SO2 emission from a high stack, the pattern of SO2 emission from a low emission source, the SO2 emission pattern in an industrial area with several emission sources, the frequency distribution of emission levels in industrial areas, the superposition of SO2 emission from two stacks of different height, and the SO2 emission pattern in weather inversions are described. To reduce SO2 emission from furnaces, a balance between fuel sulfur content reduction, desulfurization of flue gases, and smoke dilution through the building of high stacks must be reached which, considering local circumstances, would keep SO2 emission within permissible limits at lowest cost. This will in most cases be achieved by a combination of measures as exemplified on a German electric power plant burning oil convertible to coal. Whenever weather inversion was of such long duration that the stack height was insufficient to handle SO2 emission, the plant was switched from oil to coal or its output was reduced. Another power plant was equipped with storage tanks for low sulfur content oil to replace its normally high sulfur oil in case inversions should generate too high SO2 pollution.
APTIC-23757

### ATMOSPHERIC DIFFUSION EXPERIMENTS AND PREDICTION MODELS.

Nucl. Safety, 5 (4):403-409, Summer 1964. 39 refs.
James J. Fuquay, and Charles L. Simpson.
Identifiers: *Diffusion models, Ground level, Plume behavior, Tracers, Winds, Stability (atmospheric).

Data from diffusion experiments are discussed with respect to an evaluation of general diffusion models and the need for new models. Referance data from ground release experiments were obtained for a wide range of atmospheric stabilities, and ground exposures were measured in some cases to distances 20 miles from the source. Differences between observed and predicted exposures become important at travel times beyond 10,000 sec. This corresponds to distances beyond 10 miles, which is the region in which greater demands for prediction are being made. Extrapolation of the Cramer, Sutton, and Pasquill curves yields an order of magnitude difference at 10,000 sec; because of their relative curvatures, this difference becomes greater as the travel time increases. The Hanford curve, which results from a model that attempts to account for deposition, appears to predict the exposures at the larger distances reasonably well. (Author summary modified)
APTIC-23769

### MECHANISMS FOR REMOVAL OF CARBON MONOXIDE FROM THE ATMOSPHERE. (FINAL REPORT).

GCA Corp., Bedford, Mass., NAPCA Contract
CPA 22-69-36, GCA-TR-70-6-G, 42p., April 1970.
24 refs. CFSTI: PB 192188
Jerome Pressman, L. M. Arin, and Peter Warneck.
Identifiers: *Hydrosphere, *Carbon monoxide, *Photooxidation, Oceans, Catalytic oxidation, Mathematical analyses, Lower atmosphere, Middle atmosphere, Methanes, Sodium chloride, Ozone, Catalysis, Ph.

Results are presented from theoretical and laboratory investigations to identify natural chemical processes by which carbon monoxide is oxidized and removed from the atmosphere. Three aspects were studied. Photochemical CO oxidation in the stratosphere is a significant sink for CO, removing 11-15% per year of the total CO inventory of the troposphere on the basis of the reaction, OH plus CO yields CO2 plus H. Reaction of CO with ozone in the troposphere does not provide a significant CO sink. However, the oxidation of CO by ozone is catalyzed by methane present in the CO as an impurity in the ppm range. Since methane is a significant trace constituent in the troposphere, further study should be directed toward the possible importance of a catalyzed CO oxidation by ozone as a removal process. In exploratory experiments of CO oxidation in aqueous solutions by pH measurements, simple sodium chloride solutions in concentrations found in seawater promoted the interaction of CO and oxygen. However, studies reporting the oceans as a source of CO suggest that, on net balance, the catalytic oxidation of CO in seawater does not offer the promise for future research of other potential removal processes. (Author summary modified)
APTIC-23788

### THE NATIONAL AIR POLLUTION POTENTIAL FORECAST PROGRAM.

Weather Bureau, Washington, D. C., National Meteorological Center, ESSA-TM-WBTM NMC 47, 18p., May 1970. 19 refs. CFSTI: WBTM NMC 47
Edward Gross.
Identifiers: *Air pollution forecasting, Advisory services, Alerts, Federal governments, Diurnal, Data-handling systems, Transport, Meteorology, Winds, Weather forecasting, Stagnation.

Air Pollution Potential (APP) is defined as a measure of the inability of the atmosphere to adequately dilute and disperse pollutants emitted into it based on values of specific meterological parameters of the macroscale features. To delineate areas on the macroscale in which high APP has the greatest probability of occurring, a stagnation index was developed independent of mixing height and transport wind speed data. The associated stagnation conditions are usually manifested by stable stratification, weak horizontal wind speed components and little, if any, significant precipitation. The numerical and subjective means by which stagnation areas are delineated and mixing height and transport wind speed calculated are described, as well as the means by which high APP conditions are transmitted to our users via facsimile and teletypewriter. The data depicted on the facsimile product will be the basis of the National Meteorological Center's National Air Pollution Potential Advisory. In addition, the daily facsimile and teletype transmissions should increase the confidence level among Weather Bureau field office forocasters and other users in preparing local statements of high air pollution potential. The resulting program is a joint effort of the Development Division of the National Meteorological Center and the Division of Meteorology of the National Air Pollution Control Administration (NAPCA).
APTIC-23790

### THE MOUNTAIN IRON DIFFUSION PROGRAM: PHASE 1. SOUTH VANDENBERG: VOLUME 1. (TECHNICAL REPORT).

Battelle-Northwest, Richland, Wash.,
Atmospheric Sciences Section, AFWTR-TR-67-1,
280p., Nov. 1967. 4 refs. CFSTI: BNWL-572
W. T. Hinds, and P. W. Nickola.
Identifiers: *Fuels, *Missiles and rockets, *Diffusion models, Computers, Air pollution forecasting, Plume behavior.

The objective of Project Mountain Iron - Phase I South Vandenberg was to develop a system for describing the potential of the atmosphere for diffusing and diluting pollutants employed as propellants in launch preparation and operations for the South Vandenberg area. Mesoscale atmospheric diffusion parameters were introduced into range safety considerations through a computer -controlled data acquisition and display system. Diffusion equations were either applied by computer program to predict the final extent of the existing potential toxic hazard, or by forecaster manipulation through tables or computer program. Two parallel approaches were pursued in deriving the equations: one was based on physical reasoning and the use of time as the downwind variable; the other was a purely statistical approach with distance as the downwind variable. The difference between the two equations is minimal, but the statistical approach yielded slightly more accurate predictions of plume behavior and substantially simpler data manipulations. To offer some guidance in the judicious use of the equations, the limits imposed by test conditions are briefly examined. In conjunction with the work leading to the prediction equations, several subsidiary facets of diffusion over South Vandenberg were studied. The topics included short-term releases, trajectory analysis of some of the tests, and ways of constructing trajectories. Conclusions reached in these secondary investigations are summarized.
APTIC-23791

### A COMPUTER PROGRAM FOR THE FALL AND DISPERSION OF PARTICLES IN THE ATMOSPHERE.

Travelers Research Center, Inc., Hartford, Conn.,
Sandia Corp. Contract 48-4932, 213p., April 1967.
11 refs. CFSTI: SC-CR-67-2530
K. D. Hage, P. S. Brown, G. Arnason, S.
Lazorick, and M. Levitz.
Identifiers: *Computer programs, *Diffusion models, *Fallout, Particulates, Particle size, Simulation, Lower atmosphere, Upper atmosphere, Line sources, Point sources, Transport, Winds, Clouds, Turbulence (atmospheric).

A computer program for calculating the transport, fall, and dispersion of solid spherical particles from a high-altitude point or line source in a simulated atmospheric wind field is described. The program is intended for use as a tool in estimating concentrations and deposit densities for aerospace nuclear safety hazards analyses. It can be used for source altitudes up to 90 km and for density 10 particles with diameters from about 3 to 300 micron (or density-size combinations with equivalent terminal velocities). The transport and fallout processes are simulated by trajectories derived from particle terminal velocities and the wind speeds along the particle paths. The dispersion of particles resulting from the interaction of atmospheric turbulence, wind shears, and variations in terminal velocities within a cluster is simulated by subdivision of volumes containing the particles, followed by the generation of new trajectories for each subdivision. Two wind fields can be used in the program: the first consists of a mean east-west flow, and a single sinusoidal wave component, of arbitrary phase speed, amplitude, and vertical variations; the second consists of a mean east-west flow and long or planetary waves that were derived from mean winter data below 30 km in the northern hemisphere. Highly simplified short- or synoptic-scale waves with arbitrary phase speeds, amplitudes, vertical variations, and vertical velocities can be added to the latter wind field if this is desired. Both wind fields are represented in spherical coordinates as continuous functions of space over the globe and as continuous functions of time if a phase speed is specified for the wave components. Limitations of the model resulting from inadequate data on particle dispersion rates and winds over large portions of the atmosphere, and from the discrete nature of source simulation, trajectory integrations, and cloud subdivisions have been discussed previously. The numerical results produced by the model have not been verified by experiments. Detailed program specifications, descriptions, operating instructions, and a FORTRAN listing are included. Computational aids to simplify the preparation of input constants and to minimize the possibilities of inconsistent or incomplete input are included. Examples of both input and output for the two distinct types of computation possible with the program are given in an Appendix. (Author summary modified)
APTIC-23792

### METEOROLOGICAL EFFECTS ON CARBON MONOXIDE DISTRIBUTION AT AN URBAN INTERSECTION.

Vanderbilt Univ., Nashville, Tenn., Thesis
(Ph.D.), Ann Arbor, Mich., Univ. Microfilms,
Inc., Aug. 1969, 198p. 54 refs.
Frederick Gene Ziegler.
Identifiers: *Streets, *Meteorology, *Carbon monoxide, Diurnal, Urban areas, Engine exhausts, Vehicles, Air quality measurements, Sampling methods, Altitude, Diffusion, Winds, Clouds, Temperature (atmospheric), Inversion, Turbulence (atmospheric).

An investigation of meteorological effects on carbon monoxide distribution at an urban intersection is presented. The study was initiated to determine the vertical distribution of CO at an urban intersection, the acceptability of a carbon monoxide profile as a sensitive indicator, and to develop sampling systems and techniques for measuring important meteorological conditions and carbon monoxide profiles. Intersection measurements consisted of CO at different elevations, temperature at different elevations, and wind speed, azimuth, and elevation. Data on temperature, winds, and cloud cover were available from the local weather bureau. Carbon monoxide was not found in concentrations that are presently considered to be dangerous. Traffic volume and CO concentration exhibit a diurnal cycle which is also affected by turbulence. During periods of slight inversion, the CO concentration was significantly higher than during non-inversion conditions. The relationships between urban and rural conditions are noted. Future work involving traffic studies, building restrictions, and model development is recommended.
APTIC-23793

### TURBULENCE IN THE ATMOSPHERIC BOUNDARY LAYER ABOVE STEPPE AND SEA SURFACES.

Bull. Acad. Sci. USSR, Phys. Atmos. Oceans
(English translation from Russian of: Izv. Akad.
Nauk SSSR, Fiz. Atmosfery i Okeana), 4 (10):591-
599, Oct. 1968. 9 refs.
Yu. A. Volkov, V. P. Kukharets, and L. R.
Tsvang.
Identifiers: *Oceans, *Plains, *Lower atmosphere, *Turbulence (atmospheric), Ussr, Meteorological instruments, Altitude, Advection, Clouds, Winds, Temperature (atmospheric), Topographic interactions, Light radiation.

Measurements of the turbulence and radiation characteristics at various heights (within the atmospheric boundary layer) above the steppes and sea were undertaken with a specially equipped LI-2 aircraft. The equipment included instruments for measuring the fluctuations of the vertical components of wind velocity and temperature, radiation balance meters for measuring radiation flux, and instruments for measuring temperature and atmospheric humidity profiles. The main characteristics of turbulence in the atmospheric boundary layer depend essentially on the type of underlying surface. In summer, the intensity of the turbulent fluctuations and the magnitude of the turbulent heat fluxes above the steppes are considerably greater than those above the sea. Above the steppes, the values of the turbulent heat flux depend on the presence of clouds. The relationship between the turbulent heat flux and the potential-temperature is very complex, and to represent this dependence with the aid of the turbulent heat exchange coefficient for the atmospheric boundry layer requires additional study of the dependence of the turbulent heat exchange coefficient on stratification conditions, height, the nature of the underlying surface, and other factors. The contributions of turbulent, radiative, and advective heat fluxes to the heating of the atmospheric boundary layer above the steppes in summer are of the same order of magnitude.
APTIC-23796

### ON THE RISE OF HOT PLUMES IN THE ATMOSPHERE.

Intern. J. Air Water Pollution (London), vol. 9:175-
198, 1965. 19 refs.
F. H. Schmidt.
Identifiers: *Mathematical analyses, *Plume behavior, *Stability (atmospheric), Europe, Stacks, Altitude, Winds, Temperature gradient, Topographic interactions.

A theory on the rise of hot plumes is developed that differs from existing theories in that it finds no maximum height is reached by a hot plume in an adiabatic atmosphere; such a plume rises indefinitely. That such an indefinite rise does not occur in the real atmosphere stems from the fact that the atmosphere is never adiabatically stratified over fairly thick layers. The observed fact that a plume only rises to a finite height must, therefore be ascribed to the thermal stratification of the atmosphere and should not be contained in theoretical considerations concerned with buoyant plumes in an adiabatic atmosphere. In applying the present theory to actual plume rise in a stable atmosphere, an attempt is made to find the limits between which plume rise may be contained. Of these limits, the lower one is considered of major importance since, together with wind force and source strength, it determines the maximum possible pollution emitted by a source. Minimum plume rise depends directly on the diameter of the chimney orifice, the temperature excess of the plume at the level of the orifice, the vertical temperature

lapse rate, a parameter which resembles Sutton's parameter n, wind speed, and the roughness of the terrain. Computations based on the derived formula are in satisfactory agreement with avainble plume rise observations.
APTIC-23803

### THE GLOBAL VILLAGE PUMP.

New Scientist, 48 (721):10-13, Oct. 1, 1970.
Fred Wheeler.
Identifiers: *Weather modification, *Topographic interactions, Research programs, Meetings, Particulates, Pesticides, Coal, Fuel oils, Water pollution, Middle atmosphere, Micrometeorology, Temperature (atmospheric), Chlorinated hydrocarbons, Mercury compounds, Carbon dioxide, Sulfur dioxide, Solar radiation.

During July 1970, some 40 scientists from all the relevant disciplines and about 60 part-time advisers and consultants were at Williams College in Massachusetts reviewing all the literature and statistics that could be gathered concerning pollution and the changing environment. The Study of Critical Environmental Problems (SCEP) had the job of deciding which pollution effects are indeed global, what measurements and research are needed to repair the gaps in our understanding of these global effects, and to provide some guidance as to what kind of practical action may be needed. Global ecological influences were DDT and other toxic persistent pesticides, mercury and other toxic heavy metals, oceanic oil pollution, and excessive nutrients in rivers, estuaries and coastal waters in general. At the beginning of the industrial revolution, the carbon dioxide content of the atmosphere was probably about 280 parts per million, while it is now 321 ppm and rising at an annual rate of 0.7 ppm. SCEP recommendations include systematic study of the partition of CO2 between the atmosphere and oceans and the biomass, study of changes in the total mass of living matter and decaying products, and improvements in our estimates of future fossil-fuel burning. Climatic effects of carbon dioxide are discussed, as well as the particulate interference from the emission of sulfur dioxide in the combustion of fossil fuels. If atmospheric CO2 rises, less heat escapes from the earth and the overall temperature rises, while the small particles of SO2 absorb as well as scatter the incoming solar radiation. SCEP encourages the development of computer models of the atmosphere, as well as the study of the optics of small particles and their transport. More needs to be known about the stratosphere, particularly in the event of supersonic transport. Ecosystems are mentioned and the identification of potential global pollutants.
APTIC-23809

### CHEMISTRY OF AIR POLLUTION. PART IV. ATMOSPHERIC CHEMICAL REACTIONS IN A SYSTEM OF VARIOUS POLLUTANTS. 1.

(Taiki osen no Kagaku hanno. IV. Kakushu osenbutsukei no taikikagaku hanno). Text in Japanese. Kagaku Kogyo (Tokyo), 21 (10):1391-1398, Oct. 1, 1970. 28 refs.
Shin Suzuki.
Identifiers: *Nitrogen dioxide (no2), *Ozone, *Photochemical reactions, Japan, Urban areas, Oxidants, Infrared spectrometry, Aldehydes, Hydrocarbons, Peroxyacetyl nitrate, Nitric oxide (no), Oxygen, Solar radiation, Reaction kinetics, Reaction mechanisms.

Under sunlight, the reversible reaction: NO2 + O2--sunlight--NO + O3 is significant. Leighton had formulated a ratio of equilibrium constants for this type of reaction when the intensity of sunlight and the concentration of the reacting chemicals are held constant. The concentration of ozone can be calculated by assuming that phi equals 1 in the formula: (NO) (O3)/ (NO2) equals phi k (a)/k, and assigning observed values of k (a)/k that vary over the 24-hour period. This type of calculation worked for Tokyo, but not for Los Angeles where the measured ozone concentration was as much as 200 times the theoretical value. These observations eventually led to the discovery of hydrocarbons (HC) as factors that play a large role in the formation of photochemical air pollution. In 1952, Haagen-Smit claimed that ozone was not formed merely under NO-O2 photochemical reaction, but with the existence of additional special organic matter. The subsequent NO2-O2 -HC photochemical experiment yielded the ozone spectrum among the infrared spectra. It was also eventually discovered that in the NO2-O2-HC photochemical reaction, the original HC disappears over time and other new organic compounds appear. Some of the compounds now commanding attention are peroxyacetyl nitrate, aldehydes and other nitrates. Detailed tables of reactions, oxidant production rates, and graphical analyses are presented.
APTIC-23812

### STUDY OF RAINOUT OF RADIOACTIVITY IN ILLINOIS.

Illinois State Water Survey, Urbana, AEC Contract AT (11-1)-1199, PR-8, 49p., Nov. 1969. 15 refs. CFSTI: COO-1199-18
Glenn E. Stout.
Identifiers: *Scavenging, *Thunderstorms, *Radioactive tracers, Deposition, Aerosols, Droplets, Particle size, Tracers, Clouds, Rain.

Laboratory and field experiments dealing with the problem of the scavenging efficiency of precipitating storms must confront the problem using actual storms. This requires knowledge of the thunderstorm structure, the placement of a unique chemical tracer into a prescribed part of the cloud, and the subsequent analysis of the tracer in the storm rainwater. An experiment which involved releasing a tracer into a specified portion of a convective cloud and measuring the aereal deposition of the chemical at the surface is described. Determining the scavenging efficiency of a thunderstorm requires a complete budget of the tracer material. A description of the tracer budget requires a chemical analysis of the rainwater, a meteorological analysis of the synoptic situation, and knowledge of the micro-physical parameters of the convective system. An assessment of the movement of particulates, both artificial and natural, through a thunderstorm system requires knowledge of the identity, size, and concentration of the particles entering the storm. Investigations of raindrop size distributions and the collection efficiencies of droplets for spores of one micron diameter are also conducted.
APTIC-23848

### THE USES OF METEOROLOGICAL DATA IN LARGE SCALE AIR POLLUTION SURVEYS.

110p., June 1958. 16 refs.
Personal Author Not Recorded.
Identifiers: *Area surveys, *California, *Meteorology, Costs, Diurnal, Monthly, Seasonal, Urban areas, Visibility, Data analysis, Air pollution forecasting, Dispersion, Winds, Temperature (atmospheric), Topographic interactions.

The applicability of existing California meteorological data to air pollution uses is considered in detail. Weather data sources are listed and evaluated, and the costs of reproduced data are given. The various uses of the data are described and related to the general and air pollution climatology of the state. Two general factors in pollution surveys are emphasized: pollution distribution as dictated by meteorological conditions, and as affected by weather factors modified by natural topography. Published summaries were sufficient for evaluation of general pollution potential in large areas but often inadequate for town- or city-size areas; in addition, the information often lacked geographical completeness and omitted several types of summarizations. In general, the standard weather summaries can be interpreted to reveal: (1) the general pattern of air circulation on a monthly or seasonal basis; (2) the average natural ventilation of the area based on average daily wind movement data; (3) areas of naturally limited visibility (provided care is taken to eliminate data from stations influenced by man-made restrictions to visibility); (4) the general effect of topographical influences on weather variables; and (5) in areas where upper air data are available, the monthly and seasonal variations of the distribution of temperature with height. Specific recommendations are made for revisions of present practices.
APTIC-23849

### RELATION OF THE STABILITY PARAMETERS IN THE ATMOSPHERIC BOUNDARY LAYER TO THE RAYLEIGH NUMBER.

Bull. Acad. Sci. USSR, Phys. Atmos. Oceans (English translation from Russian of: Izv. Akad. Nauk SSSR, Fiz Atmosfery i Okeana), 4 (12):758-759, Dec. 1968. 4 refs.
V. N. Ivanov, and A. Ye. Ordanovich.
Identifiers: *Mathematical analyses, *Stability (atmospheric), *Atmospheric boundary layer, Ussr, Altitude, Convection (atmospheric), Turbulence (atmospheric).

The dynamic Richardson number Rf is one of the widely used parameters characterizing turbulent atmospheric conditions, while the Rayleigh number Ra is the characteristic parameter for cellular convection. Since dissipation of turbulent energy due to dynamic factors can be determined using a formula for a known heat flow, and the exchange coefficients and dissipation of turbulent energy are connected and can be expressed by one another, the possibility of connecting the Rayleigh and Richardson numbers was analyzed. The close agreement obtained between the numerical estimates of critical values of the Rayleigh and Richardson numbers shows the connection of the critical Richardson number with the effect of the emergence of large scale convection.
APTIC-23853

### COLLECTION EFFICIENCY OF WATER DROPLETS FALLING THROUGH AN AEROSOL. A PRELIMINARY REPORT.

International Atomic Energy Agency, Vienna (Austria), Treat. Airborne Radioact. Wastes, Proc. Symp., New York, 1968, p. 533-540. 8 refs. (Aug. 26-30.)
M. Kerker, E. Matijevic, N. S. Viswanathan, and D. D. Cooke.
Identifiers: *Scavenging, *Aerosols, *Droplets, Particle size, Diffusion, Rain, Turbulence (atmospheric), Sodium chloride.

The scavenging of aerosol particles by water droplets is a means of which air may be cleaned, and it results in the dumping of the atmospheric and stratospheric radioactive aerosols onto the surface of the earth. The mechanism involves hydrodynamic flow patterns, the diffusion of the particles, and turbulence. An experiment designed to determine the collection efficiency of water droplets falling through a sodium chloride aerosol is described. The results indicate a collection efficiency of approximately 7%. The particle size of the aerosol, as determined by light scattering, is reported. The analysis of the NaCl collected was carried out by flame photometry. The results are not sufficiently precise to permit definitive statements about the effect of such variables as droplet size, particle size, droplet speed, and aerosol concentration upon the collection efficiency.
APTIC-23854

### OZONE PRODUCTION DURING THUNDERSTORMS, MEASURED BY THE ABSORPTION OF ULTRAVIOLET RADIATION FROM LIGHTNING.

J. Geophys. Res., 72 (14): 3557-3561, July 15, 1967. 9 refs.
Richard E. Orville.
Identifiers: *Ultraviolet spectrometry, *Thunderstorms, *Ozone, Electricity (atmospheric), Corona.

The only spectrum of a single lightning flash containing the short-wave ozone absorption cutoff has been obtained. An analysis of this absorption in the 2850-A region indicates that a few tenths of a millimeter (0.01-0.05 cm) of ozone existed between the slit-less spectrograph and the flash occurring at a distance of 0.85 km. This value is one order of magnitude greater than the clean air value. In addition, an experiment is suggested to determine whether the ozone increase associated with thunderstorms exists as a mantle around the lightning channel and, hence, is produced by lightning, or whether it exists as an evenly distributed gas in the intervening path and, hence, is produced by corona discharge in the vicinity of the storm. (Author abstract modified)
APTIC-23868

### MIXING HEIGHT DETERMINATIONS BY MEANS OF AN INSTRUMENTED AIRCRAFT.

Florida Univ., Gainesville, NAPCA Contract CPA 22-69-76, 30p., June 1970. 5 refs. CFSTI: PB 193419
R. O. McCaldin, and R. S. Sholtes.
Identifiers: *Mixing height, *Aircraft, Aerosols, Visibility, Altitude, Diffusion, Winds, Temperature gradient, Turbulence (atmospheric).

In a general sense ambient air pollutant concentrations are a function of the rate of pollutant emission, wind speed and direction, and the altitude to which pollutants can mix. The mixing layer concept as employed by Holzworth is investigated by making a series of measurements. One hundred forty-five atmospheric soundings were made in an instrumented aircraft to determine the vertical temperature structure, atmospheric turbulence as indicated by an accelerometer, and height to which pollutants were mixed as determined by aerosol concentrations. Mixing height measures based on each of these techniques were then compared with estimated mixing heights based on Holzworth's method. There was no statistical difference between the Holzworth estimates and aircraft turbulence measures of the mixing height. Mixing heights based on aircraft temperature profiles were 7 to 9 percent smaller than the Holzworth and aircraft turbulence techniques. This is thought to be due to the criteria used to select mixing heights from the aircraft temperature profiles. There was no statistical difference between mixing heights based on Holzworth's technique and aerosol distribution. However, only a poor correlation was found, probably due to detection of aerosols which had been moved aloft on previous days. Marked differences in visibility below and above the mixing layer were photographed, and particle concentrations in each atmospheric regime were recorded. In New Orleans for example, there were about fifty times more particles in the mixing layer than found in the clean air above. (Author abstract modified)
APTIC-23878

### CALCULATION OF THE FREQUENCY DISTRIBUTION OF NOXIOUS GAS CONCENTRATION IN THE SURROUNDINGS OF SINGLE SOURCES.

(Berechnung der Haeufigkeitsverteilungen der Schadgaskonzentration in der Umgebung einer Einzelquelle). Text in German. Staub, Reinhaltung Luft, 30 (7):298-303, July 1970. 4 refs.
Gerhard Manier.
Identifiers: *Stack gases, *Mathematical analyses, *Point sources, *Gases, Germany, Air quality measurements, Ground level, Winds.

The frequency distribution of noxious gas concentration is calculated for the surroundings of three individual emission sources at different heights. The investigations are based on frequency distribution of propagation, wind velocity, and wind direction as determined at a local airport. Many characteristic values for the frequency distribution of concentration are determined and their special distribution is shown. The changes in ground load factors caused by a single source are investigated. (Author abstract modified)
APTIC-23899

### THE USES AND LIMITATIONS OF TREND SURFACE ANALYSIS IN STUDIES OF URBAN AIR POLLUTION.

Atmos. Environ., 4 (3):333, May 1970.
L. G. Veitch.
Identifiers: *Mathematical modeling, *Dispersion, *Meteorology, Australia, Urban areas.

Trend surface analysis, which simplifies initial data, is invaluable in permitting a broad view of the air pollution pattern in an area. One model is presented that requires only three parameters for a straightforward physical description of air. However, a model obtained from a principal component analysis of a representative sample (perhaps 300 occasions over a three-year period) is considered to represent a more general and safer approach. This model presumes that dilution is the major factor for the great majority of the variability between different occasions.
APTIC-23912

### AIRBORNE MEASUREMENT OF TURBULENT FLUXES.

J. Geophys. Res., 5 (24): 4506-4518, Aug. 20, 1970. 17 refs.
Mikio Miyake, Mark Donelan, and Yasushi Mitsuta.
Identifiers: *Aircraft, *Meteorological instruments, *Turbulence (atmospheric), Japan, Canada, Potentiometric methods, Automatic methods, Anemometers, Thermistors, Lower atmosphere, Winds, Humidity, Temperature (atmospheric).

The use of the 'eddy correlation' method to determine the surface turbulent fluxes from an aircraft requires the measurement, over a suitable interval and with sufficient frequency response, of two components of wind speed, temperature, and humidity. The measurement of the air velocity components also demands information on the motion of the aircraft. To obtain this data at measured natural frequency intervals of 0.028 Hz to 28 Hz at 10 meters above the surface, a fast-response sensor system was developed. This paper describes the system at the time of the Barbados oceanographic and meteorological experiment (Bomex) in May 1969. The turbulence sensors comprised a hot-wire anemometer for measuring relative horizontal velocity, a sonic anemometer for measuring relative vertical velocity, a thermistor for temperature measurements, and a Lyman-alpha humidiometer for measuring the vapor content of air. Information on the motion of the aircraft was supplied by two accelerometers and a gyroscope equipped with potentiometers. A sample data run from Bomex is used to illustrate the characteristics of the sensory system and attendant data-analysis methods.
APTIC-23913

### COEFFICIENTS OF THE LEGENDRE AND FOURIER SERIES FOR THE SCATTERING FUNCTIONS OF SPHERICAL PARTICLES.

Appl. Opt., 9 (8):1888-1896, Aug. 1970. 19 refs.
J. V. Dave.
Identifiers: *Legendre series, *Fourier series, *Light scattering, Particle size, Mathematical analyses, Scattering (atmospheric), Light radiation, Refractive index.

Results of computations are presented to show the variations of coefficients of four different Legendre series, one for each of the four scattering functions needed in describing directional dependence of the radiation scattered by a sphere. Values of the size parameter (x) covered for this purpose vary from 0.01 to 100.0. An adequate representation of the entire scattering function versus scattering angle curve is obtained after making use of about 2x plus 10 terms of the series. However, a section of a scattering function versus scattering angle curve can be adequately represented by a Fourier series with less than 2x plus 10 terms. The exact number of terms required for this purpose depends upon values of the size parameter and refractive index, as well as upon the values of the scattering angles defining the section under study. Necessary expressions for coefficients of such Fourier series are derived with the help of the addition theorem of spherical harmonics. The abuse method is advantageous for obtaining a very fine picture of the directional dependence of scattering characteristics for spherical polydispersion encountered in the atmosphere. (Author abstract modified)
APTIC-23931

### WIND DISTRIBUTION ASYMMETRY IN THE LOWEST 90 METERS AND ITS EFFECT ON DIFFUSION.

J. Appl. Meteorol., 9 (4):588-591, Aug. 1970. 11 refs.
Thomas H. Pries.
Identifiers: *Lower atmosphere, *Diffusion, *Winds, Mathematical analyses, Atmospheric movements, Convection (atmospheric), Stability (atmospheric), Turbulence (atmospheric).

The assumption is often made that the turbulent fluctuations of the wind components are normally distributed. The validity of this assumption was examined for the first 90 m of the atmosphere by observing the skewness of the wind component distribution as related to atmospheric stability and height above the ground. Observations from South Dartmouth, Mass., Brookhaven, N. Y., and Cape Kennedy were analyzed. Skewness of the longitudinal and vertical components of the wind was a function of atmospheric stability and height above the ground. Whereas the vertical component varied inversely with the stability and directly with height, the skewness of the frequency distribution of the longitudinal component tended to increase with increasing stability and to decrease algebraically from one level to the next higher level. Application of the vertical velocity component to diffusion is considered. Only in the case of free convection should diffusion estimates be corrected for asymmetry of the frequency distribution of vertical motion. (Author abstract modified)
APTIC-23933

### SHORT-TERM VARIATIONS IN THE VERTICAL DISTRIBUTION OF ATMOSPHERIC OZONE AT ALBUQUERQUE, NEW MEXICO.

J. Appl. Meteorol., 9 (4):697-701, Aug. 1970. 7 refs.
John G. Breiland.
Identifiers: *Altitude, *Dispersion, *Ozone, New mexico, Ozonesondes, Lower atmosphere, Middle atmosphere, Atmospheric movements, Pressure (atmospheric).

Variations with time in the vertical distribution of ozone during a period of influx of subtropical air associated with a shortwave ridge and a cold middle tropopause were studied in detail by means of a series of ozone soundings taken at intervals varying from 4 to 6 hours. A chemiluminescent type ozonesonde was utilized for measuring the atmospheric ozone, while the flight package also included a standard Bendix-Friez AMT-4 radiosonde. In the lower stratosphere, the vertical distributions of the partial pressure of 03 were characterized by secondary maxima and minima that could be followed from sounding to sounding. However, a general decrease in the partial pressure of 03 with time took place at nearly all levels in the lower stratosphere as the ridge advanced over the station. The most significant changes in 03 with time were observed in the layer between altitudes of 9 and 18 km. A pronounced minimum in the partial pressure of 03 persisted at the 18.5-km level throughout the entire period of observations. Such a minimum may be formed when a thin, upper layer of the cold tongue of subtropical air associated with the quasi-permanent, longwave pressure system is left undisturbed as the lower part of the cold tongue is being replaced by ozone-rich polar air associated with a short-wave trough moving through the longwave system. The

minimum formed in this way may persist for a long time if not modified by either a significant change in the longwave pressure pattern or by a shortwave disturbance that reaches to an altitude greater than that of the minimum. (Author abstract modified)
APTIC-23934

### THE EFFECT OF POLLUTION ON RADIATION IN THE ATMOSPHERE.

Intern. J. Air Pollution, vol. 1:31-43, 1958. 13 refs.
P. A. Sheppard.
Identifiers: *Absorption, *Scattering (atmospheric), *Solar radiation, *Light scattering, Seasonal, Great britain, Particulates, Particle size, Lower atmosphere, Temperature (atmospheric), Topographic interactions, Cooling, Refractive index.

Absorption and scattering by a polluted atmosphere are considered in relation to solar radiation and terrestrial radiation. Scattering and absorption by particulates are considered in the light of Mie theory, in regard both to the polar diagram of scattered light and to the extinction cross-section as a function of wavelength, particle diameter, and refractive index. Single scattering is mainly forward but multiple scattering, which is significant for transmissions less than about 0.75 (transmission of solar radiation by a heavily polluted column may often be less than this limit) results in a greater fraction of backward scatter. Some observations of WALDRAM on polar diagrams of scatter and on transmission over the bottom kilometre of a polluted atmosphere are quoted to show that more than 30% of the solar beam may be scattered and more than 25% absorbed by the column. Of the 30% or more scattered, probably less than half would be lost to the atmosphere by upward scatter. Observations of solar radiation, direct and diffuse, in central London and on its periphery, provide further values of scatter and absorption which point in the same direction as do those of WALDRAM. Terrestrial radiation appears to suffer significant absorption by particulates even in a rural atmosphere and it is much stronger in London. The effect is to increase the cooling rate of the bottom kilometre or so of the polluted atmosphere by as much perhaps as 2 to 3 C per day. The ground surface must then cool somewhat less by terrestrial radiation. Computations by Moeller on a model atmosphere containing a given distribution and amount of particulate matter are broadly in line with this conclusion. Thus there is significant upward scatter of solar radiation by pollution (a loss of heat to the atmosphere) and a significant absorption, which replaces a corresponding absorption at the ground. The absorption of solar radiation is offset by increased emission of terrestrial radiation by the layer concerned, and the latter loss will be dominant in mid-winter conditions when solar energy is necessarily small. (Author abstract modified)
APTIC-23948

### A PRELIMINARY STUDY OF AIR TRAJECTORIES IN THE LOS ANGELES BASIN AS DERIVED FROM TETROON FLIGHTS.

Monthly Weather Rev., 91 (10-12): 583-604, Oct.-Dec. 1963. 10 refs.
D. H. Pack, and J. K. Angell.
Identifiers: *Tetroons, *Los angeles, *Atmospheric movements, Balloons, Altitude, Lower atmosphere, Diffusion, Anticyclones, Winds, Sea breeze, Inversion, Topographic interactions.

During May and early June of 1963, 88 tetroon-transponder flights were made at relatively low level in the Los Angeles Basin. Five different tetroon release sites were utilitzed, extending from Point Dume northwest of Los Angeles to Sunset Beach southeast of Los Angeles. The tetroons, and attached transponders, were positioned at 3-min intervals by means of the newly installed Weather Bureau WSR-57 radar on Blackjack Mountain, Catalina. Through the use of transponders the problem of ground clutter was eliminated, and tetroon positions were obtained at ranges exceeding 50 mi even when the tetroon was only a few feet above the ground. More than 400 hr of tetroon-tracking time were obtained, with the longest single track of 21 hr duration. In general, the wind speeds derived from successive tetroon positions were small, averaging 4.4 kt for all flights and only 2.4 kt for flights released from Corral Beach. Aircraft tracking on more than 20 of the flights confirmed that the mean tetroon floating altitude was between 1000 and 1500 ft. However, while the tetroon height over the ocean varied little, over the land in the unstable marine layer repetitive height variations of as much as 2000 ft were noted. There was a marked tendency for tetroon heights to vary in accordance with terrain height, and, particularly in the case of the Palos Verdes Hills, a systematic vertical motion pattern was delineated. On the basis of 7 pairs of simultaneous tetroon releases, for the first 100 min, the square of the horizontal separation distance tends to be proportional to time to the third power. However, at times greater than 100 min, the tetroons occasionally draw closer together. In the case of tetroons released from the same site, but at different times, the distance between tetroon positions tends to increase nearly linearly with time after release, attaining an average value of 15 mi, 4 hr after release. Surprisingly, the time interval between tetroon release does not appreciably affect this latter statistic. Analysis of the spreading or diffusion of serial trajectories in a spatial frame of reference shows that the lateral standard deviation is proportional to downstream distance to the 0.8 to 0.9 power, values comparable to those derived by quite different methods. Considered is a series of trajectories from Long Beach which indicates land and sea breeze effects, and a series of trajectories from Venice which shows a veering of the sea breeze flow with time. A few flights from Sunset Beach suggest that at times, near the base of the inversion, there may exist a large anticyclonic cell (reverse of the usual Catalina eddy) over the Los Angeles Basin. (Author abstract)
APTIC-23949

### ATMOSPHERIC DIFFUSION STUDIES AT THE NARF SITE.

General Dynamics, Fort Worth, Tex., Nuclear Aerospace Research Facility Contract AF 29 (601)-6213, Proj. 6773, Task 677305, Program Element 6.54.02.12.4, Rept. NARF Rept. FZK-206, WL TR-64-156, 102p., June 1965. 24 refs.
CFSTI, DDC: AD 618101
H. G. Bradbury.
Identifiers: *Reactors (nuclear), *Diffusion, *Radioactive tracers, Statistical analyses, Plume behavior, Tracers, Inversion, Temperature gradient.

Associated with every nuclear reactor facility is the problem of evaluating and monitoring the airbone radioactivity that may result during normal operations and/or during certain conceivable accident situations. Four atmospheric diffusion experiments were conducted in the Nuclear Aerospace Research Facility area at General Dynamics/Fort Worth in order to study the dispersal and dilution factors of the atmosphere as they pertain to the release of airborne radioactivity in the NARF area. Fluorescent dye was released to the atmosphere from a point near the Reactor Operations Building and sampled downwind to measure depletion factors under varying meteorological conditions. The tests were performed with air temperature gradients ranging from slightly unstable to mildly stable (inversion) situations. The sampling data obtained were applied in the evaluation of the parameters associated with the statistical diffusion equation. Although the four tests were too few in number to provide substantial statistical data, the results show that under the poorest diffusion conditions experienced, the effluent depletion factors ranged from approximately 0.001 to 0.00001 between 88 and 704 m from the release point. These factors are considerably less than those actually being applied under nuclear safety considerations within the NARF reactor operations area. (Author abstract modified)
APTIC-23956

### METEOROLOGY OF ATMOSPHERIC POLLUTION.

(Meteorologie der Luft-beimengungen). Text in German. Free Univ. of Berlin, Inst. for Theoretical Meteorology, 126p, 1969. 119 refs.
R. A. McCormick, and B. Gutsche.
Identifiers: *Atmospheric phenomena, Germany, Urban areas, Stack gases, Industrial emission sources, Stacks, Mathematical analyses, Air pollution forecasting, Dispersion, Diffusion, Diffusion models, Plume behavior, Meteorology, Winds, Micrometeorology, Inversion, Turbulence (atmospheric).

All aspects of meteorology of industrial pollutants are reviewed. The areas covered include the following: air pollution cycle (principal pollutants, time-related concentration changes, spatial concentration changes); atmospheric turbulence (mathematical definition, characteristics of turbulence); atmospheric diffusion and the behaviour of smoke plumes (looping, coning, fanning, lofting, fumigation, trapping of smoke plumes, stability categories, phenomena affecting the use of flue gases); the calculation of dispersion (diffusion equation, multiple stacks, stack heights); the application of the diffusion equation and diffusion models for urban areas (Lucas model, Pooler model, Turner model, Fortak model, Miller and Holzworth model, Clarke model); the pollution cloud over urban areas (dispersion properties, mixing areas, warning system); potential accumulation of pollutants (synoptic scale, small scale, wind velocity); and its forecasting and atmospheric clouding (absorption effects, dispersion, aerosol content).
APTIC-23962

### OBSERVATIONS OF AEROSOLS OVER NORTHEASTERN COLORADO.

National Center for Atmospheric Research, Boulder, Colo., NCAR-TN-49, 64p., June 1970. 26 refs.
G. M. Hidy, R. Bleck, I. H. Blifford Jr., P. M. Brown, and G. Langer.
Identifiers: *Aerosols, *Dispersion, *Clouds, Colorado, Non-urban areas, Urban areas, Particle counters, Aitken counters, Particle size, Ground level, Lower atmosphere, Meteorology, Convection (atmospheric), Winds, Temperature (atmospheric), Nucleation, Ice.

In a study of possible links between aerosol behavior and cloud formation, a series of ground and airborne observations of meteorological parameters and condensation and ice nuclei were conducted in northeastern Colorado during the 1968 summer. Although no link was established, the measurements indicated that the aerosol population at the ground and at 20,000 ft and above was somewhat variable from day to day, but that particle concentrations at 2000-3000 ft above the ground were relatively more constant in time and space over a 40-mi square area above the Pawnee Grasslands. In general, the aerosol concentrations in a size range above 0.15-micron radius were remarkably low at cloud base. Aitken and ice nuclei were quite variable but fell within a range of concentrations more or less typical of rural, continental conditions. Aerosol samples appeared to consist mainly of materials of non-maritime origin, with differences reflecting the passage of different air masses over the sampling region. The low concentrations of aerosols observed over rural areas just east and north of light urban zones is of special interest in connection with the influence of pollution in the test area. During the summer observational period, it was concluded that the convective motion, combined with relatively low wind speeds, tends to disperse localized particulate pollutants sufficiently into relatively clean air so that their contaminating influence only a few tens of miles away is virtually undetectable. Some evidence that relatively heavy pollution from great distances could persist at higher altitudes was found in samples of aged aerosols that originate far from Colorado. (Author summary modified)

APTIC-23992

### INTERACTION OF A HEATED JET WITH A DEFLECTING STREAM. (SUMMARY REPORT).

Minnesota Univ., Minneapolis, Heat Transfer
Lab., NASA Contract NAS 3-7904, NASA CR-
72613, HTL TR-92, 70p., April 1970. 14 refs.
NTIS: N70-30948
J. W. Ramsey, and R. J. Goldstein.
Identifiers: *Wind tunnels, *Plume behavior, *Flow rates, Testing facilities, Fog, Temperature (atmospheric), Turbulence (atmospheric), Temperature.

An experimental investigation of the interaction of a heated jet with a deflecting flow was performed in a wind tunnel. The secondary (jet) flow was introduced at angles of 90 deg and 35 deg to the mainstream flow direction. Visualization studies using tufts of yarn and a carbon dioxide-water fog are reported. Temperature profiles in the interaction region are presented for blowing rates (ratio of mass flux of injected gas to mass flux of freestream) from 0.1 to 2.0 for normal injection and at blowing rates of 1.0 and 2.0 for 35 degree injection. Velocity and turbulence intensity profiles are reported for normal injection at blowing rates of 1.0 and 2.0. The instantaneous jet boundary is very irregular with large scale eddies. As the jet enters, mainstream air is entrained from the sides filling the low pressure region immediately downstream of the jet. At large blowing rates, a reverse flow region exists on the downstream side of the entering jet. Temperature profiles show increasing jet penetration with increasing blowing rates. The wall temperature is influenced in two counteracting ways as the blowing rate is increased. The increased secondary mass flow and resulting increased enthalpy addition to the stream tends to increase the temperature. However, the increased penetration moves the jet axis farther from the wall and tends to lower the wall temperature. Comparisons between perpendicular and 35 degree injection show that there is less penetration and less vertical and lateral spreading for 35 degree injection. Low velocities are measured near the wall directly downstream of the incoming jet. Above this region, the velocity increases, reaching a maximum which can be greater than the freestream velocity and then decreases to the freestream value. Very large turbulence intensities are measured in the low velocity region. Some distortion of the mainstream is observed as far as twenty-six diameters downstream of the injection position.
APTIC-23993

### ELECTRIFICATION PROCESSES IN WARM RAIN CLOUDS.

Environmental Science Services Administration,
Boulder, Colo., Atmospheric Physics and
Chemistry Lab., TR-ERL 103-APCL 5, 102p.,
Feb. 1969. 55 refs.
Lothar H. Ruhnke.
Identifiers: *Electricity (atmospheric), *Clouds, *Rain, Aitken counters, Computers, Mathematical analyses, Mathematical modeling, Radiosondes, Winds, Temperature (atmospheric), Electrical properties, Electric charge.

Observations of electric charges, fields, and currents of precipitating 'warm clouds' (clouds whose temperatures are above zero C at all times and in all parts of the cloud) in Hawaii are reported as a basis for discussion of possible mechanisms leading to electrification of raindrops from non-thunderstorm clouds. Measurements including use of radiosonde flights, and Aitken nuclei counter, and the radioactive probe collector method with a solid state electrometer. Positive charges were of the order of 0.0001 esu and were correlated with wind speed. Electric fields in rain clouds were generally positive except at the lower cloud boundary where negative fields of up to -1000 V/m existed. Several thunderstorm theories are discussed and their applicability to the warm rain mechanism is examined. A new hypothesis incorporating an 'influence mechanism' and based on raindrops that collect space charge by diffusion is presented to explain the positive charge of warm rain. Numerical solutions to drop charges and electric field profiles using a realistic cloud model were obtained through the use of digital computer techniques. The theoretical results for charges on raindrops and electric field patterns agree well with observations.
APTIC-23995

### PRECIPITATION FROM COOLING TOWERS IN COLD CLIMATES.

Massachusetts Inst. of Tech., Cambridge, Fluid
Mechanics Lab., Grant NIH-1-ROI - AP 00 67-02,
Pub. 70-7, 30p., May 1970. 18 refs. NTIS: PB
192626
Thomas J. Overcamp, and David P. Hoult.
Identifiers: *Cooling towers, *Electric power production, *Precipitation, *Weather forecasting, Nuclear power plants, Steam plants, Stacks, Ground level, Diffusion models, Plume behavior, Humidity, Temperature (atmospheric), Condensation, Freezing, Water, Vapors, Thermodynamics.

The conditions causing precipitation from a natural draft cooling tower, used to control thermal pollution caused by waste heat from coal-fired and nuclear power plants, are analyzed. Precipitation from the condensation of water vapor is strongly dependent on the plume's trajectory, the flux of water vapor from the tower, and the ambient temperature and relative humidity. If the plume does not mix with the wake, there is no precipitation because the flow time is significantly shorter than the time to form rain drops. If the plume interacts with the wake and strikes the ground, there will be diffusion of small droplets to the ground. Calculations based on equilibrium thermodynamics and a simple diffusion model show that this can give a tenth of a centimeter an hour in cold weather. This could freeze and be hazardous to travel. These results can be used to predict precipitation for a natural draft cooling tower in a particular location. The probability of the plume striking the ground is first estimated using meteorological records for wind intensities, the performance of the tower, and an interaction chart which is given. This is combined with the local temperature records to predict the rate and frequency of precipitation. (Author conclusions modified)
APTIC-24001

### THERMODYNAMIC CONSIDERATIONS IN THE INTERACTIONS OF NITROGEN OXIDES AND OXY-ACIDS IN THE ATMOSPHERE.

Preprint, Robert A. Taft Sanitary Engineering
Center, Cincinnati, Ohio, 16p., 1956 (?). 16 refs.
Aubrey P. Altshuller.
Identifiers: *Nitrogen dioxide (no2), *Thermodynamics, Nitric acid, Nitrous acid, Nitric oxide (no), Nitrous oxide (n20), Ozone, Photolysis, Reaction kinetics, Reaction mechanisms.

The thermodynamic equilibrium constants are computed for a number of chemical reactions involving nitrogen oxides and oxy-acids. The nitrogen oxides likely to be present in any substantial quantity in the atmosphere are nitrous oxide, nitric oxide, and nitrogen dioxide. The concentrations of reactants and products in these reactions at chemical equilibrium are given, and the rates at which these reactions proceed towards equilibrium are discussed. Most of the reactions considered are 'dark' reactions, but the importance of photochemical reactions involving ozone is pointed out and the photolysis of nitrogen dioxide is discussed in detail. The varying importance of the individual reactions of nitrogen oxides in air pollution problems is emphasized. (Author abstract modified)
APTIC-24015

### NUMERICAL EXPERIMENTS IN MODIFYING THE KINETICS OF CLOUD SPECTRUM FORMATION BY INTRODUCING ADDITIONAL CONDENSATION NUCLEI.

Tr. Inst. Eksp. Meteorol., no. 6:3-9, 1969. 2 refs.
Translated from Russian. Joint Publications
Research Service, Washington, D. C., 9p., May
15, 1970. CFSTI: JPRS 50525
Yu. S. Sedunov.
Identifiers: *Cloud seeding, *Aerosols, Ussr, Droplets, Particle size, Clouds, Colloids.

A discussion of modifying clouds by introducing additional condensation nuclei is presented. A theoretical investigation of the effect of adding aerosols to natural ones is given. Results indicate that additional drops are formed, leading to a more highly dispersed distribution, and consequently, to greater colloidal stability of the clouds. Modification will have the greatest effect if the nuclei have minimal activity within the limits of the size and activity range for which drop formation occurs. The technical feasibility of the plan depends to a large extent on the possibility of obtaining sufficiently monodisperse aerosols and regulation of their size in order to increase the effectiveness of their utilization. The size of such aerosols with known chemical composition is determined.
APTIC-24016

### OPTICAL COEFFICIENT OF DIFFUSION AND AEROSOL CONCENTRATION IN THE TROPOSPHERE AND STRATOSPHERE BY MEASURING THE POLARIZATION OF SCATTERED SOLAR RADIATION IN THE ZENITH BY MEANS OF A RADIOSONDE.

(Optischer Streukoeffizient und
Aerosolkonzentration in Troposphaere und
Stratosphaere aus Messungen der Polarisation der
Sonnenstreustrahlung im Zenit mittels
Radiosonden). Text in German. Kleinheubacher
Ber., vol. 13:7-15, 1969. 14 refs. CFSTI: N70-27754
F. Unz.
Identifiers: *Lower atmosphere, *Turbidimetry, *Aerosols, Seasonal, Germany, Particle size, Radiosondes, Middle atmosphere, Diffusion, Solar radiation, Light scattering.

A method is developed which permits the determination of the exponent of the aerosol size distribution and the turbidity in the troposphere and stratosphere, assuming a power law for the aerosol size distribution. A measurement of the degree of polarization in two wavelengths in necessary for this method. The scattering coefficients and absolute particle concentrations may be derived as a function of height from the turbidity value. Measurements made during 9 ascents show great fluctuations in values and heights of the maximum stratospheric turbidity. Maximum seasonal values occur at the 22-26 km height. The highest concentration of particles with a radius greater than 0.08 micron is near 50 particles/cc. For the greatest measured stratospheric turbidities, the extinction from light scattering is 10-20 times greater than the extinction for pure molecular scattering. There is always a minimum of turbidity in the troposphere. (Author summary modified)
APTIC-24027

### SYSTEMS STUDIES OF DDT TRANSPORT.

Science, 170 (3957):503-508, Oct. 30, 1970. 28 refs.
H. L. Harrison, O. L. Loucks, J. W. Mitchell, D.
F. Parkhurst, and C. R. Tracy.
Identifiers: *Ecosystems, *Ddt, *Transport, Pesticides, Mathematical analyses, Diffusion models, Chlorinated hydrocarbons.

Some predictions of the consequence of adding dichloro-diphenyl-trichloro-ethane to the environment based on the DDT transport, accumulation, and concentration mechanisms and on the evidence of the impact of DDT in ecosystems are now possible. The presence of DDT in any trophic level can have three major consequences: the concentration may be high enough to kill the members in that level, after which the entire ecosystem will move toward a new equilibrium; the concentration may not be lethal, but may cause adverse sublethal

effects that the affected trophic level will disappear just as if the dosage were lethal; and the concentration may have no apparent effect on the trophic level, and the DDT in this level will then pass on to the next higher trophic level. Analysis of DDT diffusion through the trophic structure of the ecosystem indicates that the equilibrium concentrations will be a function of the 'life span' of the organisms in the system. Radical changes in population levels could have serious economic and public nuisance consequences. Descriptive models for the transport of DDT are included, as well as a mathematical analysis of DDT concentration. (Author conclusions modified)
APTIC-24075

### THE WEATHER AND CIRCULATION OF JULY 1970.

Monthly Weather Rev., 98 (10):789-794, Oct. 1970.
1 ref.
Raymond A. Green.
Identifiers: *Air pollution episodes, *Meteorology, Monthly, Atmospheric movements, Anticyclones, Winds, Precipitation, Rain, Temperature (atmospheric), Weather maps.

Weather highlights, mean circulation, temperature, and precipitation are discussed for July 1970, when a cold Canadian High gradually transformed into a warm anticyclone and a threat of dangerous concentrations of air pollution developed over several Eastern States. Over North America, the 700-mb mean circulation closely resembled the normal; but elsewhere in the hemisphere, there were large departures in several systems. Among these, the most notable was the negative anomaly of 90 m in a deep vortex over the Norwegian Sea. The principal axis of maximum west winds was north of its usual July path around most of the hemisphere, with average windspeeds more than 15 m inverse sec over parts of the northcentral Pacific and northeastern Atlantic. Easterly winds were much faster than normal south of the strong central Pacific High. The absence of record-breaking low temperatures for the month as a whole is in good agreement with the prevalence of positive height departures over the United States. However, record daily minima far outnumbered maxima, mostly attributable to an outbreak of Canadian air after midmonth. Rainfall exceeded normal just west of the Continental Divide and in the Great Lakes Region. The latter area appears to be well related to the mean trough and slightly negative height anomalies, while the western precipitation was associated with the amplified ridge over the Rocky Mountains. Florida received more than 10 inches at a number of stations, mostly brought by the tropical storm Becky. A large area from the lower Rio Grande Valley to southern Illinois received less than half the normal rainfall. The weather for July is also indicated by weeks.
APTIC-24104

### ICE FOG. LOW TEMPERATURE AIR POLLUTION.

Army Cold Regions Research and Engineering
Lab., Hanover, N. H., Grants DA-ENG-11-190-
61-G3, DA-ENG-27-021-62-G5, and DA-AMC-27-
021-64-G8, RR 121, 118p., June 1970. 196 refs.
NTIS, DDC: AD 708544
Carl S. Benson.
Identifiers: *Fog, *Inversion, *Ice, Alaska, Stack gases, Droplets, Coal, Fuel oils, Gasolines, Particle size, Ground level, Convection (atmospheric), Pressure (atmospheric), Temperature (atmospheric), Stagnation, Bromine, Chlorine, Lead compounds, Carbon dioxide, Sulfur dioxide, Supercooling, Light radiation, Crystal structure, Vapor pressure.

Stable pressure systems over interior Alaska sometimes produce prolonged, extreme (below -40 C) cold spells at the surface. The rate of radiative cooling of the air is enhanced by suspended ice crystals which are themselves a result of the initial cooling. Radiation fogs formed during the onset of cold spells are generally of short duration. The polluted air over Fairbanks allows droplets to begin freezing at the relatively high temperature of -35 C. Between -35 and -40 C the amount of water vapor condensed by freezing of super-cooled water droplets is 3 to 5 times greater than the amount condensed by 1 C of cooling at these temperatures. This results in rapid and widespread formation of ice fog which persists in the Fairbanks area as long as the cold spell lasts. The persistence of Fairbanks ice fog depends on a continual source of moisture from human activities within the fog. Most of the ice fog crystals have settling rates which are slower than the upward velocity of air over the city center. The upward air movement is caused by convection cells driven by the 6 C 'heat island' over Fairbanks. This causes a reduced precipitation rate which permits the density of ice fog in the city center to be three times greater than that in the outlying areas. The inversions which occur during cold spells over Fairbanks begin at ground level and are among the strongest and most persistent in the world. Thus, the low-lying air over Fairbanks stagnates and becomes effectively decoupled from the atmosphere above, permitting high concentrations of all pollutants. The combustion of fuel oil, gasoline, and coal provides daily inputs of carbon dioxide, sulfur dioxide, lead, bromine, and chlorine into a lens-like layer of air resting on the surface. The air pollution over Fairbanks during cold spells is further worsened, because the mechanisms for cleaning the air are virtually eliminated while all activities which pollute the air are increased. (Author abstract modified)
APTIC-24109

### THE POTENTIAL TEMPERATURE PROFILE IN THE PLANETARY BOUNDARY LAYER.

George C. Marshall Space Flight Center,
Huntsville, Ala., Aero-Astrodynamics Lab., TM-
X-64519, 40p., April 27, 1970. 11 refs. NTIS: N70-
31161
George H. Fichtl, and Julian F. Nelson.
Identifiers: *Temperature (atmospheric), Mathematical modeling, Ground level, Lower atmosphere, Temperature gradient.

The profile of mean flow potential temperature in the first 150 meters of unstable planetary boundary layer is analyzed with a sample of nineteen temperature profiles observed at the NASA 150-meter meteorological tower site. The observations consist of mean temperatures observed at 3-, 18-, 30-, 60-, 120-, and 150-meter levels. The duration time of each test ranged between approximately fifteen minutes to one hour. It is hypothesized that the dimensionless potential temperature gradient is a dimensionless function of the mean flow potential temperature at heigh z, the surface values of the friction temperature and friction velocity, the surface Monin-Obukhov stability length, and the Coriolis parameter. According to Buckingham's theorem, only two independent dimensionless quantities can be constructed from this set; however, these dimensionless quantities can be chosen in a variety of ways. Accordingly, the dependencies of the mean flow potential temperature on the various coordinates are examined. One function in particular summarized the data reasonably well, and other functions derived from it also agree with experimental results. Integration of the differential equation of the particular function yields the potential temperature profile. For sufficiently small values of the quantity Lambda, the potential temperature profile has a logarithmic behavior with a linear defect resulting from stability and Coriolis effects, where z is the surface roughness length of the site. The potential temperature profile is used to evaluate the drop in potential temperature across the planetary boundary layer. The depth of the boundary layer is assumed to be surface function velocity/4 (Coriolis parameter). (Author abstract modified)
APTIC-24111

### CHARGING OF DROPLETS BY IMPULSE CORONA.

J. Geophys. Res., 75 (24): 4483-4490, Aug. 20,
1970. 12 refs
C. T. Phelps, and B. Vonnegut.
Identifiers: *Droplets, *Corona, *Electricity (atmospheric), Particle size, Clouds, Thunderstorms, Particle growth, Electric charge.

Many physical parameters relating to small-scale dynamics and interactions in thunderclouds are dependent on droplet charge. A lightning discharge will drastically change the droplet charge spectrum. The lightning discharge presumably develops from dielectric breakdown of air via a rapid corona process. Experiments involving the production of impulse corona of both polarities within a cloud of droplets atomized from a solution of glycerin and water are described. The observed charging of droplets with radii in the range 2.5 to 15 micron is characterized by a maximum surface charge density that is nearly constant down to about 6 micron and increases for radii below that if other electric and geometric parameters are fixed. The largest surface charge densities observed for droplets with radii above 6 micron are approximately 0.00004 coul/sq m for positive corona and -0.00006 coul/sq m for negative corona. Results suggest quite different charging mechanisms for the two corona polarities. With positive corona, the droplet charging appears to result from direct interaction between the positive streamers and the droplets. These findings indicate a possible link between the lightning discharge and subsequent rapid cloud droplet growth. (Author abstract modified)
APTIC-24136

### THE INFLUENCE OF A VERTICAL WIND PROFILE ON DEPOSITION OF DUST PARTICLES FROM ELEVATED SOURCES.

Acta Geophys. Polon. (Warsaw), 18 (1):51-63,
1970. 10 refs.
Kazimierz Wojciechowski.
Identifiers: *Deposition, *Dusts, *Winds, Europe, Mathematical analyses, Altitude, Stability (atmospheric).

A new formula for dust deposition takes into account the influence of vertical wind profile on dispersion of the dust plume. Because of the lack of sufficient experimental checks concerning dust deposition, the results obtained with the formula are compared only with those computed with the formulas of Sutton and Krieb. Differences in results are attributed to differences in atmospheric stability. It is concluded that consideration of the vertical wind profile rather than the assumption of constant wind velocity gives a better picture of deposition. (Author abstract modified)
APTIC-24138

### RATE CONSTANTS FOR THE REACTION OF CO2 (+) WITH O, O2 AND NO; N2 (+) WITH O AND NO; AND O2 (+) WITH NO.

Planetary Space Sci., 18 (8):1267-1269, Aug. 1970.
6 refs.
F. C. Fehsenfeld, D. B. Dunkin, and E. E.
Ferguson.
Identifiers: *Carbon dioxide, *Nitric oxide (no), *Oxygen, *Photochemical reactions, *Reaction kinetics, Nitrogen, Ions.

Because of its importance in the Martian ionosphere, the reaction of CO2 (+) with atomic oxygen was measured in a flowing afterglow system at 295 K. The reaction has a rate constant of 2.6 times 10 to the minus 10th power cu cm/sec and appears to produce both O2 (+) and O (+) as product ions, approximately in the ratio 5:3. The similarity of the rate constants for O and O2 reaction suggest that the products compete for CO2 (+) distribution approximately according to their respective concentrations. The ultimate product of CO2 (+) reactions in a CO2-O-O2 atmosphere is O2 (+). Also included are measurements of the reactions of CO2 (+) with O2 and NO, the reac-

tions of N2 (+) with O and NO, and the reaction of O2 (+) with NO. The rate for the last reaction, which is of great importance for O2 (+) yields NO (+) conversion in the E-region of the terrestrial ionosphere, is 6.3 times 10 to the minus 10th power cu cm/sec plus or minus 30%.
APTIC-24143

### CONCENTRATIONS IN MOUNTAIN AREAS OF PARTICLES RELEASED AT LOW ELEVATIONS.

Quart. J. Roy. Meteorol. Soc. (London), 96 (409): 535-538, July 1970. 6 refs.
A. Gagin, and J. Neumann.
Identifiers: *Ice, *Nucleation, *Lower atmosphere, Seasonal, Asia, Mountains, Altitude, Winds, Precipitation, Inversion.

Concentration measurements of ice nuclei active at -15 C were taken in Jerusalem at a point 800 m above msl from September 1967 to December 1968. The results indicate very high concentrations in the late summer, when the daily average is 1-10 nuclei (10 l) of air, and low concentrations in other seasons. As determined by an examination of mixing conditions in the lower atmosphere upwind of Jerusalem, most of the particles are carried by vertical mixing from upwind areas of low elevation. The largest concentrations occur mainly on days when a subsidence inversion limits the mixing depth to between 800 and 1400 m above msl, i. e., when mixing conditions in the lower atmosphere upwind of Jerusalem are favorable up to heights corresponding to Jerusalem's elevation and a few hundred meters above it. An important source for the ice nuclei is probably the industrial complex of Tel Aviv, northwest of Jerusalem.
APTIC-24145

### THE THICKNESS OF THE PLANETARY BOUNDARY LAYER.

Atmos. Environ., 4 (3):325, May 1970. (Includes a reply by S. R. Hanna concerning his paper which appeared in Atmos. Environ., vol. 3:519-536.)
J. Counihan.
Identifiers: *Boundary layer, *Lower atmosphere, Great britain, Height finding, Ground level, Winds, Neutral condition, Turbulence (atmospheric).

Recent work at the Central Electricity Research Laboratories, England, indicates a height of about 600 m for the planetary boundary layer in neutral conditions. Although good agreement is obtained utilizing the author's methods, a large degree of experimental scatter in individual occasions is indicated. It appears that the boundary layer height for neutral conditions can be predicted fairly well from measurements near ground level, while it is speculated whether the vertical scale of longitudinal turbulence can be estimated from the O'Neill velocity measurements. This would provide another means of checking the boundary layer height, but this has not been attempted. Generally the direction of the geostrophic wind is known only within about plus or minus 20 deg, thus introducing a possibility for large errors in H (d), even when the wind profile is completely accurate. Also, because the wind speed does not generally vary much between the heights of 100 m and 1000 m during the daytime, the height at which the speed is a maximum may shift several hundred meters from hour to hour.
APTIC-24151

### URBAN AIR POLLUTION BY VEHICLE EXHAUST GASES AND ITS COUNTERMEASURE (I).

For primary bibliographic entry see Field 04.
APTIC-24158

### FURTHER OBSERVATIONS OF THE URBAN HEAT ISLAND IN A SMALL CITY.

Bull. Am. Meteorol. Soc., 51 (7):602-606, July 1970. 10 refs.
Richard J. Kopec.
Identifiers: *Heat islands, *Commercial areas, *Temperature (atmospheric), Plants (botany), Winds, Clouds, Turbulence (atmospheric), Heat transfer.

The heat island effect was studied in the twin, nonindustrial communities of Chapel Hill and Carrboro, N. C. by means of mobile traverses designed for both urban and rural horizontal temperature measurements. A dozen traverses were made over a nine-month period covering winter, spring, and summer. Nowhere did regions of higher temperatures induced solely by altitude approach temperature maxima generated by low-profiled, linearly arranged central business districts and large university buildings. The heat island effect was evident over the study area when sky cover was less than 2/10ths and wind velocities were under five knotts. The abundant coniferous vegetation of the area appeared to have the capacity to substitute for a lack of tall buildings and to produce an effect on wind velocity and turbulence comparable to that produced by a city having a high roughness index.
APTIC-24164

### INVESTIGATION OF TURBULENT EXCHANGE AND WASH-OUT BY MEASUREMENT OF NATURAL RADIOACTIVITY IN SURFACE AIR.

J. Geophys. Res., 75 (18):3669-3674, June 20, 1970. 10 refs.
V. N. Bakulin, E. E. Senko, B. G. Starikov, and V. A. Trufakin.
Identifiers: *Diffusion, *Washout, *Isotopes, Diurnal, Ussr, Mathematical analyses, Ground level, Lower atmosphere, Convection (atmospheric), Turbulence (atmospheric), Bismuth compounds, Lead compounds, Radon, Radioactive radiation.

Based on a comparison of methods of measuring the degree of disequilibrium between the short-lived decay products of radon Ra (222), an improved and simplified method is proposed for general use. In accordance with theoretical considerations, the existence of a linear dependence between Po218 (RaA)/Pb214 (RaB) and RaB/Bi214 (RaC) concentration ratios in the atmosphere is established, permitting determination of the atmospheric concentrations of Rn, RA, RaB, and RaC from two points on the radioactivity decay curve for aerosol samples collected on a filter. As a rule, two maximums in the diurnal variation of disequilibrium between radon and its daughter products have been observed. From the differences in this variation at altitudes of 1, 11, and 20 m, an attempt is made to explain the mechanism of convective and dynamic components of turbulent exchange near the ground. From the diurnal variations of radon and thoron concentrations at 1 and 5 m and their short-lived decay products at 1, 11, and 20 m, the diurnal change in the turbulent diffusion coefficient in the surface layer is computed and compared with that from meteorological parameters. The velocity of washout of the troposphere is estimated from Ra/Pb210 (RaD) concentration ratio variations averaged for one-day intervals. (Author abstract modified)
APTIC-24166

### STRATOSPHERIC AEROSOL MEASUREMENTS BY OPTICAL RADAR.

J. Atmospheric Terrest. Phys., 32 (9):1535-1544, Sept. 1970. 13 refs.
K. Bartusek, D. J. Gambling, and W. G. Elford.
Identifiers: *Radar, *Aerosols, *Lasers, *Middle atmosphere, Australia, Light scattering.

A laser radar is being used at Adelaide, South Australia (35 deg S) for routine studies of upper atmosphere densities and aerosol concentrations to 60 km. The transmitter operates at 0.694 micron wavelength and generates 0.2 J energy and 0.5 microsec pulse length at the rate of 20 per min. The receiver is a 12-in. Newtonian telescope equipped with an interference filter of bandwidth 8A. The light is detected by a cooled photomultiplier, and the recording is carried out by integrating photon counts from selected height intervals. Results for the period February-June 1969 show that scattering is molecular at 10-60 km, with the exception of the region 13-24 km. Here enhanced scattering is attributed to aerosols. The maximum aerosol number density, averaged over the five months, is 1,300,000/cu m and occurs at 18.5 km. (Author abstract modified)
APTIC-24167

## 6. BASIC SCIENCE AND TECHNOLOGY

### PARTICLE CHARACTERISTICS FROM LIGHT SCATTERING MEASUREMENTS.

Tellus (Uppsala), 21 (2):223-229, 1969. 20 refs.
F. S. Harris Jr.
Identifiers: *Aerosols, *Lasers, *Light scattering, *Measurement methods, Pollutants, Particulates, Particulate classifiers, Particle shape, Particle size, Physical states, Liquids, Water.

The effect of physical parameters on the light-scattering pattern of spherical latex particles suspended in water was studied with conventional and laser light sources. Some measurements were compared with Mie theory calculations, and additional calculations were made to determine the effect on scattering of variation in particle size and index of refraction. Aerosols, it was found, scatter independently of the coherence of the light source. The variation of light intensity with angle, polarization, and wavelength increases the possibilitites of discrimination. The incident light may be diagonally polarized. Incident righthand circularly polarized light, when scattered, may contain some left-hand circularly polarized light. An initial diagonal polarization can be represented by the sum of the equal components of parallel and perpendicular polarizations and the scattering of each treated independently. Laser light-scattering experiments should provide information about variation in position and time in the atmosphere.
APTIC-18274

### WORLD FUEL RESOURCES.

Power, 112 (6):S6-S11, June 1968.
R. K. Evans.
Identifiers: *Fuels, *Coal resources, *Uranium compounds, Coal, Fuel gases, Natural gas, Fuel oils, Oil resources, Electric power production, Nuclear power plants, Reactors (nuclear), Metal compounds.

Fuel reserves and new ways of converting them into usable energy are constantly being discovered. During the past 20 years, more than 364 trillion cu ft of natural gas reserves have been proved in the U. S. Proven reserves of crude oil in the world were estimated at 500 billion barrels by the end of 1967. To fuel the growing number of nuclear power plants, 100,000 tons of uranium will be needed by the end of 1972. The bulk of the known worldwide reserves of uranium are located in the U. S., Canada, and South Africa. It is difficult to estimate how much of a country's coal resource is economically recoverable. According to the U. S. Geological Survey, our recoverable coal reserves amount to 830 billion tons, a 1500-year supply at the present rate of consumption. Most coal seams in the U. S. are more accessible, substantially thicker, and more horizontal than deposits in other countries, which allows our mines to develop faster and at lower cost. Byproducts and refuse are also valuable fuel resources.
APTIC-18276

### DETERMINATION OF SIZE DISTRIBUTION AND NUMBER CONCENTRATION OF SMALL AEROSOL PARTICLES BY LIGHT-SCATTERING MEASUREMENT.

For primary bibliographic entry see Field 03.
APTIC-18281

### A BASIS FOR DETERMINING THE AMOUNTS OF UNBURNED GASES REMAINING IN INTERNAL COMBUSTION ENGINES AFTER COMBUSTION BY MEANS OF CONTINUOUS WASTE-GAS ANALYSES.

(Grundlagen der Fanggradbestimmung an Verbrennungsmotoren durch kontinuierliche Abgasanalyse.) Text in German. MTZ Motortechnische Zeitschrift, 30 (5):153-159, May 1969. 20 refs.
F. W. Huber, M. Greiner, H. Luther, and B. Wirwall.
Identifiers: *Automotive exhausts, *Analytical methods, *Combustion, Retention, Germany, Automotive emissions, Engine exhausts, Engine operating cycles, Internal combustion engines, Diesel engines, Chemical methods, Measurement methods, Automatic methods, Recording methods, Butanes, Oxygen, Automobiles.

Both Otto and diesel engines were tested on test stands for the degree of retention of unburned charge following firing of the cylinders. The measuring apparatus was mounted sufficiently close to the exhaust valve so that the waste gases were analyzed before undergoing further partial combustion. The study indicates that incomplete scavenging may be measured by obtaining the O2 content in the waste gas of the Otto motor with the aid of a magnetic oxygen recorder (MAGNOS) and by determining the n-butane content of the waste gas of a diesel motor with the aid of an infrared absorption (URAS) recorder.
APTIC-18282

### ON THE ROENTGENOLOGICAL DETECTABILITY OF DUST DEPOSITS IN THE LUNGS. STUDIES ON THE ALDERSON-RANDO PHANTOM.

(Zur Frage der roentgenologischen Darstellbarkeit von Staubdepots in den Lungen. Untersuchungen am Alderson-Rando-Phantom.) Text in German. Beitr. Silikose-Forsch., 97:1-21, 1968. 14 refs.
T. Goebbeler, W. Klosterkoetter, E. Loehr, L. Magnus, and E. Scherer.
Identifiers: *Radiography, *Silicosis, *Dusts, Lungs, Diseases and disorders, Respiratory diseases, Pneumoconiosis, Germany, Pollutants, Particulates, Sources, Industrial emission sources, Mineral processing, Mining, Photometric methods, X rays.

Experiments were conducted to determine detectability in the lungs of mine dusts by means of X-rays. An Alderson-Rando phantom, which very faithfully simulates human body structure and X-ray absorption capacities, was used to simulate the human body. Mine dusts with varying ash and pyrite contents, and with particle sizes less than 60 millimicrons, were deposited in varying thicknesses on paraffin plates. These were placed in various segments of the phantom. Dusts with ash contents of 26% are detectable in the lung phantom, down to a minimum of 3.3 mg. This ash content represents the lower critical range of normal mine dusts. Photometric measurements show an almost linear relation between dust content and photometric density. It is concluded that mine dust embedded in the silicotic lung contributes to the formation of shadow spots in X-ray photographs.
APTIC-18289

### ELECTROCHEMICAL CONCENTRATION CELLS FOR GAS ANALYSIS.

Ann. Geophys., 25 (1):203-210, 1969. 6 refs.
W. D. Komhyr.
Identifiers: *Electrochemical, *Concentration cell, *Monitoring, Electrochemical methods, Trace analysis, Iodine compounds, Iodides, Sulfur oxides, Sulfur dioxide, Ozone, Electrolysis, Electrical properties.

Several types of iodine/iodide redox electrode concentration cells are described that are useful for monitoring selected atmospheric oxidants and reductants at concentrations down to one part per billion. The basic cell is comprised of two bright platinum electrodes immersed in potassium iodide solution. It is similar to that described by Glueckauf et al. (1944) except it derives its driving e.m.f. from the difference in electrolyte concentrations surrounding its cathode and anode. Tests to determine the effect of solution evaporation on the cell output current showed that dilute solutions yielded low ozone values while more concentrated solutions gave high ones. Tests were also made to compare the performance of old and new cells. The cells have been successfully employed to measure the vertical distribution of atmospheric ozone, and have been used for monitoring near ground-level ozone and sulfur dioxide.
APTIC-18292

### INVESTIGATION OF ELECTROCHARGING DURING FLUIDIZATION AND EXPLANATION OF THE SHAPE OF SEPARATED MATERIALS.

Documenta Chemica Yugoslavica, 28:513-522, 1963. 6 refs. Translated from Yugoslavian.
S. K. Koncar-Djurdjevich.
Identifiers: *Particulates, Europe, Settling particles, Dusts, Particulate classifiers, Particle shape, Sampling methods, Particulate sampling, Samplers, Control equipment, Collectors, Electrostatic precipitators, Filters, Experimental equipment, Experimental methods, Electricity (atmospheric), Electrical properties, Electric charge.

Solid particles in a fluidized bed receive an electrostatic charge as a result of friction with other particles and the walls of the bed. Both electric and hydrodynamic processes are involved in charging the particles, and many factors, such as the dielectric constant of the fluidized mass, have pronounced effects on the results. The polarity of the charged species in mono-and multi-dielectric systems and the characteristics of deposits of these species were studied. Moisture-free air was used to fluidize dried particles in a bed fitted with D. C. electrodes. The charge on the fluidized particles was determined by observing the polarity of the electrode on which the particles collected (e.g. positive particles are attracted to the negative electrode). During the fluidization of one-component systems, both positively and negatively charged particles were found. In two-component systems, the species with the higher dielectric constant was generally positively charged. This is in agreement with Koehn's Law. Sand, a constituent of all three-component systems examined, was always negatively charged, the other two holding a positive charge. On rod-shaped electrodes, particles would form a cluster at the lower, free end of the rod when the electrode was grounded to the metallic bed-supporting screen. When the electrode was insulated, two clusters were formed. One, the component usually attracted to that electrode, formed a band part way up the shaft. The other component formed the usual cluster on the end of the rod. Materials tested include KNO3, SiO3, NaCl, Mg CO3, Ca CO3, BaSO4, Pb (NO3)2, and coal.
APTIC-18308

### KINETICS OF THE PYROLYSIS OF 1,2-DIIODOETHYLENE.

Intern. J. Chem. Kinet., vol. 1:147-156, 1969. 11 refs.
Shozo Furuyama, David M. Golden, and Sidney W. Benson.
Identifiers: *Iodinated hydrocarbons, *Pyrolysis, *Reaction kinetics, Spectrophotometry, Iodine, Acetylenes, Ethylene, Catalysis.

The spectrophotometric determination of the rate of pyrolysis of 1,2-diiodoethylene from 305.8 to 435.0 deg (with additional data on the addition of iodine to acetylene from 198.1 to 331.6 deg) has resulted in the observation of both a (in part heterogeneous) unimolecular process, and an iodine atom catalyzed process. It is suggested that a donor-acceptor complex intermediate may explain the observed rate constant of the latter process and analogous reactions in other systems. (Author abstract modified)
APTIC-22178

### A NEW MACHINE FOR INDUSTRIAL LIQUEFACTION OF GASES.

(Nouvelle machine pour la liquefaction industrielle des gaz). Text in French. Genie Civil, 139 (9):206-211, May 1, 1962.
F. Lafay.
Identifiers: *Compression, *Condensation, *Gases, France, Cooling, Compressed gases.

A machine for direct liquefaction of gases at atmospheric pressure is described which is especially well suited for production of cold at temperatures between -200 and -80 C. In contrast with the processes currently used for industrial production of liquid air in which the air is first pre-cooled and then undergoes either the Joule-Thompson or the Claude thermodynamic cycle, the new machine operates by the 'cold-gas' Stirling cycle which is an adaptation of the conventional 'hot-air' Stirling cycle. This (ideal) cycle involves isothermal compression at the higher temperature, isochoric cooling at the smaller volume, isothermal expansion at the lower temperature and isochoric heating at the greater volume up to the higher temperature. The required variation of the volume in the course of each cycle is approximated by the use of two pistons working in a single cylinder which are driven by connecting rods to two cranks of different radii slightly more than 90 deg out of phase on a single drive shaft. The cylindrical cooling and heating heat exchangers for the isochoric stages of the cycle completely surround the working cylinder. All parts working at different temperatures are thermally insulated from each other. Another heat exchanger forms a part of an interchangeable 'chilling head' enclosing the upper part of and surmounting the working cylinder, which serves to liquefy the cooled gas at atmospheric or an elevated pressure or to chill gas to a temperature between ambient and -160 C. Applications include separation of gases by fractionation, providing coolant for cold-treatment of metals, measurements of low-temperature properties of materials, and dessication of air.
APTIC-22181

### THE BAEYER-VILLIGER REACTION AS A SOURCE OF 'ABNORMAL' OZONOLYSIS PRODUCTS.

Tetrahedron Letters no. 11:1287-1292, 1968. 14 refs.
Paul R. Story, and John R. Burgess.
Identifiers: *Aldehydes, *Oxidation, *Ozonolysis, Oxidants, Olefins, Ketones, Ozone.

Contrary to the widely held opinion that aldehydes are not attacked as long as olefin is present, it is shown that aldehydes can be oxidized to peracid during ozonolysis and that the peracid so formed can account for the formation of 'abnormal' products through a Baeyer-Villiger oxidation. Ozonolysis of several very reactive, aliphatic olefins at low ozone flow rates in the presence of cyclohexanone, which undergoes Baeyer-Villiger oxidation readily, has produced yields of the normal Baeyer-Villiger product, 6-hexanolactone as high as 10%, based on the ozone consumed. Neat cyclohexanone or cyclohexanone/chloroform was unaffected. In order to determine that oxidation could account for formation of lactone, propionaldehyde, n-butyraldehyde, isobutyraldehyde, and pivaldehyde were ozonized in a solution of cyclohexanone and chloroform containing 20 mmoles of aldehyde at a rate of 0.75 mmole per minute for 600 sec at 0 C. The lactone yield ranged from 30 to 80% based on ozone used.
APTIC-22187

### CHRONIC NONSPECIFIC RESPIRATORY DISEASES IN THE CITY OF CRACOW. VI. ASSESSMENT OF THE INTERVIEWER ERROR.

Przeglad Epidemiol., 23 (1-2):135-145, 1969. 20 refs. Translated from Polish. Central Inst. for Scientific, Technical and Economic Information, Warsaw (Poland), Scientific Publications Foreign Cooperation Center. CFSTI: TT 69-50001/1-2
Feliks Sawicki.

Identifiers: *Health statistics, *Interviewer error, Humans, Epidemiology, Bronchitis, Europe, Data analysis, Statistical analyses, Personnel, Questionnaires, Chronic.

The underestimated influence of the person collecting interviews can bias the results of epidemiologic surveys. Interviewer influence is less pronounced in studies on chronic bronchitis using questionnaires containing closed questions requiring yes or no replies or questions concerning facts. The hazard lies in failure to follow instructions or inappropriate formulation of questions. The analysis of the interviewer error, based on the results of a pilot study, failed to reveal significant differences between interviewers regarding most of the 19 questions asked. The analysis was conducted by two methods: two-way variance analysis, and Kendall and Smith's coefficient of concordance. Statistical analysis of the interviewer bias was based on the chi-square test, one-way analysis of variance, and intraclass correlation coefficients. The similarity of the results showed that each method can be used. The results of double interviews of the same persons confirmed the tendency to overreport by interviewer No. 4 and to underreport by interviewer No. [illegible] This finding shows the need of more thorough training of the interviewers before a cross sectional survey and the necessity of random allocation of interviewers to the study units.
APTIC-22200

## CHRONIC NONSPECIFIC RESPIRATORY DISEASES IN THE CITY OF CRACOW. VII. ASSESSMENT OF THE X-RAY OBSERVER ERROR.

Przeglad Epidemiol., 23 (1-2):146-158, 1969, 11 refs. Translated from Polish. Central Inst. for Scientific, Technical and Economic Information, Warsaw (Poland), Scientific Publications Foreign Cooperation Center. CFSTI: TT 69-50001/1-2
Feliks Sawicki, Wladyslawa Martenowska, Stanislaw Janczy, and Maria Krokowska.
Identifiers: *Radiography, *Statistical analyses, *Medical personnel, *Observer error, Humans, Epidemiology, Heart, Respiratory system, Tuberculosis, Europe, Urban areas, Data analysis.

The purpose of the analysis of the X-ray observer was to assess the bias of the physicians evaluating the X-ray films in a cross sectional survey of the inhabitants of Krakow for symptoms similar to those of chronic bronchitis. During the pilot study, 363 out of 533 persons interviewed reported for clinical measurements. Small X-ray films were made for each person, and for control purposes large X-rays were made in every eighth person. The films were interpreted by three readers, identified as A, B, and C. The analysis showed marked interobserver differences in the reading of the films. The greatest discrepancy concerned evaluation of films with no changes and changes in the cardiac silhouette. Reader A showed a tendency to overread changes in the cardiac silhouette, and reader B to underread nontuberculous lesions. All the readers showed a tendency to excessive diagnosis of tuberculous lesions in small films. They also overlooked changes in the cardiac silhouette in small films, which were later noted during joint readings. The results of the first and second readings of small films by individual readers showed discrepancies, with the intraobserver error being much smaller than the interobserver error. The discrepancy between the numbers of cases of changes in the cardiac silhouette reported by the different readers, and the low values of the agreement coefficients between individual diagnoses and joint assessment of the films throw doubt on the validity of evaluation of the state of the cardiovascular system on the basis of small X-ray films in epidemiological surveys. (Author conclusions modified)
APTIC-22201

## KINETIC STUDIES OF THE REACTIONS $CH_2I_2$ + HI IN EQUILIBRIUM WITH $CH_3I$ + $I_2$ AND $2CH_3I$ IN EQUILIBRIUM WITH $CH_4$ + $CH_2I_2$. THE HEAT OF FORMATION OF THE IODOMETHYL RADICAL.

Intern. J. Chem. Kinet., vol. 1:283-296, May 1969. 12 refs.
Shozo Furuyama, David M. Golden, and Sidney W. Benson.
Identifiers: *Iodinated hydrocarbons, *Reaction kinetics, Spectrophotometry, Methanes, Chemical reactions, Thermodynamics.

The kinetics and thermochemistry of gas-phase reactions involving alkyl or aryl radicals with organic iodides are studied using spectrophotometric methods. The rate of the reaction methylene iodide + hydrogen iodide in equilibrium with methyl iodide + iodine (molecule) is followed. The rate constant and heat of formation of the reaction iodine + methylene iodide in equilibrium with methylene iodine + iodine (molecule) are studied. The kinetics of the disproportionation $2CH_3I$ in equilibrium with methane + $CH_2I_2$ are studied at 331 deg and are compatible with related values. (Author abstract modified)
APTIC-22208

## ELECTROCHEMICAL STUDY OF THE SYSTEM SN--$SNCL_2$ (KCL).

(Elektrokhimicheskoye issledovaniye sistemy Sn--$SnCl_2$ (KCl)). Text in Russian. Ukr. Khim. Zh., 29 (9):939-945, 1963.
A. A. Kolotiy.
Identifiers: *Chlorides, *Tin compounds, *Electrolysis, Ussr, Molybdenum compounds, Potassium compounds, Ionization, Ions.

The change in potential of a tin anode with respect to platinum as a function of the density of initially applied current was studied. The shift in potential is explained by a change in the ratio of mono- and divalent tin ions at the electrode, which is in agreement with the conclusions drawn for a liquid tin anode. The fractions of mono- and divalent tin ions transferred to the melt as a function of current density are calculated. A change in potential of the inert electrode (Mo) with time was observed in the presence of liquid tin dissolved in $SnCl_2$ -- KCl (20 wt %) electrolyte. A drop in potential between Mo and Sn with time occurs because of the molybdenum electrode. The tin potential rapidly stabilizes. The potential of the molybdenum electrode approaches that of the tin electrode. Under conditions of electrolytic tin plating from melts, i.e., for an $SnCl_2$ -- KCl (20 wt %) electrolyte at 300 C and high current density in the absence of mechanical mixing, the role of tin subions is insignificant in the electrochemical process.
APTIC-22209

## SURFACE TENSION OF NITRITE-NITRATE AND NITRATE SALT MIXTURES.

(Poverkhnostnoye natyazheniye nitrito-nitratnoy i nitratnoy solevykh smesey). Text in Russian. Zh. Prikl. Khim., 36 (9, 11):2542-2543, 1963. 13 refs.
Ye. L. Krivovyazib, I. D. Sokolova, and N. K. Voskresenskaya.
Identifiers: *Nitrates, *Nitrites, *Surface properties, Ussr, Potassium compounds, Sodium compounds, Temperature.

Surface tension was determined using the maximum gas-bubble pressure method for a mixture of potassium nitrate, sodium nitrate and sodium nitrite (53:7:40 wt %), and an equimolar mixture of $KNO_3$ and $NaNO_3$. The least squares method was used to derive surface-temperature polytherms from measurements made over the temperature range 200-502 C and 257-280 C, respectively. Surface tension (dyne/cm) for these two systems is expressed as (131.1 -0.054t) and (142. 9 - 0.097t), respectively, where 't' is the temperature.
APTIC-22210

## STUDIES ON ERYTHRO-KINETICS IN INFANCY. VI. A METHOD FOR THE QUANTITATIVE ESTIMATION OF PULMONARY EXCRETION OF CARBON MONOXIDE IN INFANCY.

Acta. Paediat. Scand., vol. 56:374-380, July 1967. 14 refs.
Lars Wranne.
Identifiers: *Infants, *Breathing, *Carbon monoxide, Carboxyhemoglobin, Lungs, Sweden, Colorimetry, Spectrophotometry, Calibration methods, Flowmeters.

A technique by which the pulmonary excretion of carbon monoxide in the newborn infant can be quantitatively determined is described. The expired air is collected by the aid of a breathing valve with a small dead space and low respiratory resistance. Colorimetry and spectrophotometry area used to determine the CO concentration, while the pulmonary CO excretion is calculated by the difference/ unit time in inspired and expired air. The volume of inspired air is assumed to be equal to that of expired air. In inspired air the CO content was found to vary from 0.2 to 1.5 ppm. The analysis was found to be precise even at concentrations as low as 1 ppm. Determinations of the pulmonary excretion of CO can give good estimates of the endogenous formation only if the carboxyhemoglobin concentration is stable. It is concluded that this method may be used in a steady state for the quantitative estimation of the endogenous formation of CO and of hemoglobin breakdown. However, in cases with rapidly changing hemolysis or with pulmonary function abnormalities, it is necessary to repeatedly investigate the COHb concentration.
APTIC-22214

## KINETICS OF THE IODINE ATOM CATALYZED GAS PHASE GEOMETRICAL ISOMERIZATION OF DIIODOETHYLENE. ROTATION ABOUT A SINGLE BOND.

Inter. J. Chem. Kinet., vol. 1:57-67, Jan. 1969. 9 refs.
David M. Golden, Shozo Furuyama, and Sidney W. Benson.
Identifiers: *Iodinated hydrocarbons, *Reaction kinetics, *Isomerization, Spectrophotometry, Iodine, Ethylene, Catalytic activity, Chemical bonds, Chemical reactions, Gases, Thermodynamics.

The spectrophotometric determination of the rate of iodine atom catalyzed geometrical isomerization of diiodoethylene in the gas phase from 502.8 to 209.1 K leads to a particular rate constant for the bimolecular reaction between iodine and trans-diiodoethylene. Estimates of the entropy and enthalpy change for the addition of iodine atoms to trans-diiodoethylene lead to a particular rate constant for the rotation about the single bond in the adduct radical. The theory for calculation of the rotation rate constant is presented and it is shown that while the exact value depends on the barrier height, a value of 6.8 kcal/mole for this quantity leads to a particular rate constant. The activation energy points to a better value of the group contribution to heat of formation of the group $CI_2HC$ than one based on bond activity. (Author abstract modified)
APTIC-22216

## CHEMICAL MECHANISM OF THE FLUORIDE-INHIBITION OF FERMENTATION.

(Chemischer Mechanismus der Fluorid-Hemmung der Garung). Kurze Originalmitteilungen, vol. 39:194, 1941. Translated from German. Belov and Associates, Denver, Colo, 2p.
Otto Warburg, and Walter Christian.
Identifiers: *Fermentation, *Inhibition, *Fluorides, Enzymes, Proteins, Germany, Magnesium compounds, Phosphates, Dissociation, Reaction mechanisms.

The chemical mechanism of inhibition of the ferment enolase by fluoride was investigated. Fluoride inhibition of three compounds was being determined: fluoride, magnesium salt, and phosphate. When the magnesium concentration

was constant and the fluoride and phosphate varied, the equation phosphate times fluoride times remainder of effect/inhibition of effect equal constant was found. When the phosphate concentration was constant and the fluoride and magnesium salt varied, the equation magnesium salt times fluoride times remainder of effect/inhibition of effect equal constant was found. Since it is difficult to determine such a small phosphate concentration, the equation was not tested for large fluoride concentrations. However, both equations were tested and found to be valid for fluoride concentrations of 1/20,000 to 1/100. It was concluded that the effective compound for fluoride inhibition is a complex magnesium-fluoro-phosphate. This compound combines in proportion to its concentration with the ferment protein in a dissociating manner. The specific reversible inhibition is believed to be based on the displacement of the effective magnesium salt from the protein by the complex.
APTIC-22219

### CERTAIN PROBLEMS OF THE THEORY OF AEROSOL ASPIRATION (HIGH STOKES NUMBER).

(Nekotoryye voprosy teorii aspiratsii aerozoley (bol'shiye chisla Stoksa)). Text in Russian. Izv. Akad. Nauk SSSR. Fiz. Atmos. i Okeana, 4 (4):426-443, 1968. 15 refs.
V. M. Voloshchuk, and L. M. Levin.
Identifiers: *Aerosols, *Mathematical analyses, *Fluid flow, Ussr, Aspirators.

Analytical formulas for approximate determination of the coefficient of aspiration of an aerosol through some surface at high Stokes numbers k are derived and evaluated; asymptotic relationships are plotted. These general formulas are applicable to the three Borda mouthpiece models: with separating and nonseparating flows (slit), and with separating axisymmetric flow (tube). Values of the coefficient for various Stokes numbers (0.5 to infinity) and an isokinetic factor (-0.80 to +4.0) are calculated for these models. Results from investigation of nonuniformity of a partical flow at the inlet to slit or tube are also presented.
APTIC-22227

### CHEMICAL APPLICATIONS OF METASTABLE ARGON II. A CLEAN SYSTEM FOR THE FORMATION OF N2 (A3 SIGMA (+)) UPSILON.

Chem. Phys. Letters (Asterdam), 2 (8):542-544, Dec. 1968. 19 refs.
D. H. Stedman, and D. W. Setser.
Identifiers: *Argon, *Metastasis, *Nitrogen, Spectrometry, Gases, United states.

A flow system for the production of N2 (A3 Sigma (+)) upsilon molecules and for th study of N2 (A) metatastable molecules is described. Metastable argon atoms are prepared in 0.01-0.05% concentrations by passing a flow of pure dry argon through a low-power hollow cathode discharge at about 1.5 MA at 150 volt. Nitrogen added to the flow at milliseconds downstream of the argon discharge produces a violet flame, the optimum length of which for N2 metastable production is 0.05 to 1 cm. The metastables are observed by means of their emission spectra and energy transfer reaction with NO and Hg. The system was successfully employed to study the reactions of N2 (A) with CO and HN3.
APTIC-22229

### COMPLEXES CONTAINING THE NITRATE ION.

In: Progress In Inorganic Chemistry. Frank Albert Cotton ved.), Vol. 8, New York, Interscience, 1967, p. 195-286. 389 refs.
C. C. Addison, and D. Sutton.
Identifiers: *Metal compounds, *Nitrates, *Ions, Great britain, Spectrometry, Chemical bonds, Chemical reactions.

Research work on simple metal nitrates and nitrato complexes during the last ten to fifteen years is summarized, and the significance of the works evaluated. The review is divided into three main parts. Those physical properties which are related directly to the nature of the metal-nitrate bond are discussed first. The known nitrato complexes are then discussed under two main headings, i.e., metal complexes containing only nitrate ligands and complexes containing nitrate groups and other ligands. In the latter section, an attempt is made to classify the complexes according to the nature of the accompanying ligand. It is noted that recent work has given a fuller understanding of the relations among physical properties (particularly spectra), structure, and the nature of the metal-nitrate bond. This had led to the preparation of many new nitrato complexes and a re-examination of complexes reported in earlier literature is also now justified.
APTIC-22237

### AN ORIGINAL METHOD FOR MEASURING ATMOSPHERIC DIFFUSION BY UTILIZING A RADIOACTIVE GAS EMITTED FROM A SOURCE POINT.

(Une methode originale de mesure de la diffusion atmospherique utilisant un gaz radioactif 'emis depuis un point source). Text in French. C. R. Acad. Sci. Paris, Ser. B, 267 (10-18): 741-744, Oct. 7, 1968. 3 refs.
Aime Druilhet, Jacques Fontan, Hubert Biasini, and Daniel Blanc.
Identifiers: *Diffusion, *Radioactive tracers, *Measurement methods, France, Lower atmosphere, Point sources.

A method is presented for measuring atmospheric diffusion which involves the continuous emission of thoron, a radioactive gas, from a point. It allows for the study of the diffusion of matter in the first few feet above the ground, and it permits the measurement of natural thoron. The measurement of the vertical profile of the concentration enables one to deduce the variation with the elevation of the vertical diffusiveness. Thoron produces no air pollution. If desired, it may be replaced by other radioactive gases, such as krypton, xenon, or radon.
APTIC-22239

### MOLECULAR STRUCTURE AND PHOTOCHEMICAL REACTIVITY. VIII. TYPE II PHOTO-ELIMINATION OF ALKENES FROM ALKYL PHENYL KETONES. EFFECTS OF VARYING THE ALKYL GROUP.

J. Am. Chem. Soc., 90 (21):5900-5902, Oct. 9, 1968. 10 refs.
J. N. Pitts Jr., D. R. Burley, J. C. Mani, and A. D. Broadbent.
Identifiers: *Alkyl phenyl, *Photoelimination, Phenyls, Hydrogen, Ketones, Photochemical reactions.

Results are presented for type II photoelimination quenching of alkyl phenyl ketones (0.10 M in benzene or n-hexane) at 3130 A by 2,5-dimethyl-2,4-hexadiene. Increasing the number of carbon atoms in the unbranched n-alkyl group from C4 to C14 had little effect on quantum yields for ketone disappearance. Increasing the chain length had little influence on the lifetime of the triplet state. In each case, a secondary hydrogen atom was abstracted. In the triplet state, the hydrogen atom abstracted from the gamma-carbon atom was varied from a primary to a tertiary hydrogen, and a striking increase in first-order rate constants for the intramolecular hydrogen-abstraction reaction was observed. Further studies are in progress to explain the increase.
APTIC-22252

### COMPLEX METAL HALIDES IN FUSED ALKALI NITRATES.

Iowa State Univ. of Science and Tech., Ames, Ames Lab. AEC Contract W-7405-eng-82, 78p., Dec. 1957. 56 refs.
Marlowe L. Iverson, and F. R. Duke.
Identifiers: *Halides, *Metal compounds, *Nitrates, *Reaction mechanisms, Chromates, Potassium compounds, Sodium compounds, Chemical reactions, Ions, Reaction kinetics.

The results of experiments on the extent of association in fused salts are presented. Association effects observed in solubility and rate studies in fused alkali nitrate are consistent with the assumption that complex ions such as those existing in aqueous solutions are formed between metal ions and halide ions. Rate studies suggest a mechanism for a reaction involving dichromate and nitrate ions in a fused alkali nitrate solvent. The interpretation of solubility dependence on halide concentration of metal chromate in a fused eutectic mixture of potassium nitrate and sodium nitrate in terms of complex ion formation is discussed. Kinetic studies on the rate of precipitation of a chromate salt from a dichromate solution in fused alkali nitrates are described. A discussion of the equilibrium reaction between the dichromate ion and nitrate ion in terms of an acid-base definition for oxide systems points out relationships between these kinetic studies and other equilibrium studies in fused salts. (Author abstract modified)
APTIC-22266

### LIGHT-SCATTERING TABLES. VOL I: ANGULAR FUNCTIONS: FOREWARD AND INTRODUCTION.

Leningrad, Gidrometeorologicheskoe Izdatel'stvo, 1966. 5 refs. Translated from Russian. C. R. Brightmore, Atomic Energy Research Establishment, Harwell (England), Information Branch, 11p., Dec. 1968. CFSTI: N7O-21779
L. S. Shifrin, and I. L. Zel'Manovich.
Identifiers: *Angular functions, *Light scattering, Ussr, Particle size.

Tables of the angular functions are necessary to describe the angular structure of the light field scattered by spherical particles of different dimensions. Six-figure tables of these functions for 400 orders of the partial scattered wave, with their detailed description of the field structure and their accuracy, can be used for any practical problem. For small scattering angles (up to 5 deg) the argument is taken at intervals of 0.1 deg; for larger angles, it is taken at intervals of one degree. The rainbow region is also treated in detail. The tables will find wide application in atmospheric optics, radiometeorology, actionometry and illumination engineering, as well as in colloid and aerosol optics. They are intended for engineers and scientific workers.
APTIC-22276

### CARNITINE LEVELS IN SOME HIGHER PLANTS.

FEBS Letters, 5 (3):169-170, Oct. 1969. 8 refs.
R. A. Panter, and J. B. Mudd.
Identifiers: *Plants (botany), *Carnitine, Bio-assay, Enzymes, Metabolism, Absorption.

Enzymatic assays for carnitine in higher plants were conducted using the highly specific acetyl-CoA:carnitine O-acetyltransferase. Carnitine is indicated to be present in wheat seed, wheat germ, oat seed, oat seedling, peanut seed, avocado mesocarp, and cauliflower inflorescence. In extracts of these plants and seeds, the change in absorbance was proportional to the volume of extract added to the cuvette over the range of concentration used for the assay. The reaction was strongly inhibited when no acetyl-CoA was added. With standard L-carnitine, which was three times more concentrated than any plant extract, the reaction went to completion in less than 15 min. Furthermore, on adding standard carnitine together with extracts, the change in absorbance was additive, and no inhibition of the enzyme was observed. The results suggest that acylcarnitines could be involved in beta-oxidation of seedlings or serve as a store of energy in the seed. In the seeds without measurable carnitine, biosynthesis of the carnitine may take place after germination.

APTIC-22283

### MOLECULAR STRUCTURE AND PHOTOCHEMICAL REACTIVITY. PART 7. VAPOUR-PHASE PHOTOCHEMISTRY OF CYCLOPROPANE CARBOXALDEHYDE.

Trans. Faraday Soc., 64 (549):2308-2319, Sept. 1968. 16 refs. (Presented at the International Conference on Photochemistry, Tokyo, Aug. 25-28, 1965.)
Dana G. Marsh, Erwin Heine, and James N. Pitts Jr.
Identifiers: *Photochemical reactions, *Reaction mechanisms, *Cyclopropane carboxaldehyde, United states, Aldehydes, Propanes, Vapors.

The major products obtained by the irradiation of cyclopropane carboxaldehyde in the vapor phase at 3130 A, 100-200 C, 1.7-154 mm, with light sen- sitivities from 0.6 times 10 to the 14th power to 1.1 times 10 to the 16th power, were crotonaldehyde, propylene, carbon monoxide, and cyclopropane. Minor products included hydrogen, methane, propane, butenes, bicylopropyl, and allyl- cyclopropyl. Cyclopropane was the major product at high temperatures and low light intensities. The results are interpreted in terms of a mechanism in- volving two exited states as precursors of the products. It is suggested that cyclopropane is formed in a free radical chain originating from one excited state and propylene is produced in a prima- ry process from the other; crotonaldehyde is formed from both excited states. The ratio of the radical to nonradical products is 1/3.
APTIC-22304

### DETERMINATION OF PHOSPHORUS, AR- SENIC OR SILICON BY ATOMIC SPEC- TROMETRY OF MOLYBDENUM HETEROPOLY ACIDS.

Anal. Chim. Acta, vol. 45:43-49, 1969. 5 refs.
T. V. Ramakrishna, J. W. Robinson, and Philip W. West.
Identifiers: *Arsenic compounds, *Organic phosphorus compounds, *Silicon compounds, *Atomic absorption, Spectrophotometry, Trace analysis, Experimental methods, Molybdenum compounds.

A method is described for determining trace amounts of phosphorus, arsenic, or silicon by atomic absorption spectrometry. The heteropoly- molybdic acids of phosphorus, arsenic and silicon were formed and selectively separated by means of solvent extraction, and the molybdenum present in the organic phase was determined by atomic spectroscopy with a nitrous oxide- acetylene flame. The method is rapid, simple, and accurate and is essentially free from interferences. (Author abstract)
APTIC-22307

### THE KINETICS AND MECHANISM OF THE REACTION OF IODINE WITH TETRAHYDROFURAN. A CARBON- HYDROGEN BOND DISSOCIATION ENERGY IN TETRAHYDROFURAN.

J. Am. Chem. Soc., 91 (6):1289-1292, March 12, 1969. 12 refs.
F. R. Cruickshank, and S. W. Benson.
Identifiers: *Chemical bonds, *Dissociation, *Tetrahydrofuran, Carbon black, Ethers, Hydrogen, Iodine compounds, Reaction kinetics.

The reaction of iodine (3.4-16.6 torr) with tetrahydrofuran (6.6-330.6 torr) was studied spec- trophotometrically in a static system from 500-633 K. The data are explained on the basis of the initial abstraction of a hydrogen atom by iodine being the rate-determining step. Initially significant surface effects were minimized by teflonizing the reaction vessel. The measured bond dissociation energy for the C-H bond in tetrahydrofuran is estimated to be 91.5 kcal/mole. It is concluded that the same bond energy relations hold true in open-chain vinyl ethers.
APTIC-22308

### IMPROVED AND CORRECTED TRANSITION PROBABILITIES OF ARGON I IN THE RANGE OF 9000-6000.

A. J. Quant. Spectro. Radiative Transfer, vol. 9:1489-1491, 1969. 4 refs.
S. V. Desai, and W. H. Corcoran.
Identifiers: *Argon, *Transition probabilities, Gases, Temperature.

Corrected experimental transition probabilities are presented for argon I lines arising from energy levels higher than 120,000-reciprocal-cm above the ground level. They are intended to replace previ- ously reported values which tended to be too high due to reported temperatures which were too low. The earlier values are included for comparison.
APTIC-22309

### EXPERIMENTS FOR THE DETERMINATION OF REACTION KINETIC MAGNITUDE FOR THE ISOTHERMO PYROLYSIS OF BITU- MINOUS COAL. PART II. DEVELOPMENT OF AN ANALOG COMPUTER PROGRAM AND COMPARISON OF RESULTS OBTAINED UNDER VARIOUS CONDITIONS.

(Versuche zur Bestimmung reaktionskinetischer Grossen bei der isothermen Steinkohlen- Pyrolyse). Chem. Ing. Tech., 41 (3):743-790, July 1969. 7 refs. Translated from German. Belov and Associates, Denver, Colo., 22p., May 24, 1970.
H. Luther, G. Bergmann, H. D. Engelmann, and J. Zajontz.
Identifiers: *Coal characteristics, *Computer pro- grams, *Pyrolysis, *Reaction kinetics, Germany, Methanes, Ethylene, Propanes, Carbon monox- ide, Gases.

An analog computer program was developed to determine first-order reaction kinetics involved in the isotherm pyrolysis of coal. The calculated con- stants of reaction speed can be assigned to reac- tion phases independent of the degree of car- bonization. Activation energies of 48-66 kcal/mol and thrust factors of 10 to the 13th power to 10 to the 17th power reciprocal min were determined for methane, propane, ethylene, and carbon monox- ide generated by the pyrolysis of bituminous coal. For ethane, these values lie between 50-90 kcal/mol and 10 to the 14th power to 10 to the 25th power reciprocal min. In a second analog com- puter program, kinetic reaction data obtained in the first program were used to establish degassing curves to be expected for a given speed of heating up under nonisothermal conditions. (Author in- troduction modified)
APTIC-22319

### ON THE EFFECT OF FOREIGN SUBSTANCES ON THE PHOTOCHEMICAL EQUILIBRIUM 2SO2 PLUS O2 IN EQUILIBRIUM WITH 2SO3. A COMMENT ON THE VALIDITY OF THE MASS-ACTION LAW IN THE PHOTOCHEMI- CAL EQUILIBRIUM 2SO2 PLUS O2 IN EQUILIBRIUM WITH 2SO3.

(Ueber den Einfluss von Fremdstoffen auf das Lichtgleichwicht 2SO2 plus O2 gleichwicht 2SO3. Zur Erklaerung der Geltung des Massenwirkungsgesetzes beim Lichtgleichgewicht 2SO2 plus O2 gleich 2SO3). Text in German. Z. Wiss. Photog., 33 (5):111-122, Sept. 1934. 3 refs.
Max Trautz, and Fritz Helfrich.
Identifiers: *Sulfur dioxide, *Sulfur trioxide, *Ox- ygen, *Photochemical reactions, Germany, Nitrogen, Ozone.

The equilibrium concentrations of sulfur dioxide, oxygen, and sulfur trioxide were measured in the system 2SO2 plus O2 in equilibrium with 2SO3 under irradiation by mercury quartz lamp with the addition of 4-55% argon or nitrogen. The measured equilibrium constant was 0.65 and agreed with the one obtained in the absence of foreign gas. The measurements were done to verify the law of mass action. The possibility of ozone formation in the reaction was checked by irradiation of a certain amount of O2 alone; no ozone was found. This, however, does not exclude its formation as an in- termediate product. In another experimental set- up, all gases were dried over P2O5 for several days prior to irradiation. No observable photochemical reaction took place. The absorption of various gas filters was studied in the region of the wavelength forming ozone. This wavelength was completely absorbed by an SO2 layer of 3 mm thickness. The conditions for validity of the law of mass action in photochemical equilibrium were discussed. The validity of the law is a necessity under the recogni- tion of certain simple thermodynamic considera- tions, provided the gas is homogeneously ir- radiated.
APTIC-22320

### MEASUREMENT OF THE TRANSPARENCY OF FOGS PRODUCED IN EXPERIMENTAL EQUIP- MENT.

Tr. Inst. Priklad. Geofiz. (Leningrad), no. 7:21-27, 1967. 10 refs. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., 10p., Jan. 6, 1970. CFSTI, DDC: AD 702962
O. A. Volkovitskiy, and L. N. Pavlova.
Identifiers: *Transparency, *Photometric methods, *Fog, Ussr, Experimental equipment, Testing facilities.

Inadequacies of equipment available for use in measuring the transparencies of fogs in aerosol chambers and wind tunnels were of such mag- nitude that new equipment had to be designed and built. An initial transparency for the fogs produced in the various chambers was adopted as a minimum requirement. A single-channel photome- ter was developed for use in the aerosol chamber. Measuring errors of transparency and determina- tion of the meteorological visual range in fogs are discussed. (Author abstract modified)
APTIC-22323

### MOLECULAR STRUCTURE AND PHOTOCHEMICAL REACTIVITY. XII. THE VAPOR-PHASE PHOTOCHEMISTRY OF ACROLEIN AT 3130 A.

J. Am. Chem. Soc., 91 (3):547-550, Jan. 29, 1969. 15 refs.
J. W. Coomber, and James N. Pitts Jr.
Identifiers: *Acrolein, *Photochemical reactions, Acetylenes, Butadienes, Ethylene, Carbon diox- ide, Carbon monoxide, Decomposition, Vapors.

The vapor-phase photochemistry of acrolein was studied at 3130 A between 35 and 200 deg. The major photodecomposition products were carbon monoxide and ethylene. Acetylene and butadiene were minor products, and small amounts of carbon dioxide were formed in a bimolecular dark reac- tion. These results are explained by a mechanism involving the two primary steps for decomposition of excited acrolein. The relative importance of the two processes varies with the pressure of the ir- radiated gas.
APTIC-22369

### THE PHOTODYNAMIC EFFECT OF THE CAR- CINOGEN, 3,4-BENZPYRENE, ON PARAMECI- UM CAUDATUM.

Cancer Res., vol. 23:35-44, Jan. 1963. 37 refs. (Presented at the American Association for Cancer Research, 51st Annual Meeting, Atlantic City, N. J., April 13-15, 1962 and the International Cancer Congress, 8th, Moscow, U.S.S.R., July 22-28, 1968.)
Samule S. Epstein, Marjorie Burroughs, and Myra Small.
Identifiers: *Ultraviolet radiation, *Benzo (3-4)pyrene, *Paramecium caudatum, Bio-assay, Toxicity, Carcinogens, Microorganisms, Photoox- idation.

Exposure of Paramecium caudatum to suspen- sions of 3,4-benzpyrene, followed by irradiation with long-wave ultraviolet light, results in death, at times related to a carcinogen concentration of from 1 times 0.00001 to 1 times 10 to the minus 10th power gm/ml. Before death, the cells exhibit a

progressive decrease in motility and blebbing of their external membranes. This response, termed photodynamic, is reproducible and is a sensitized photooxidation, being oxygen-dependent and inhibited by certain antioxidants. The sensitivity of the response may be modified by a variety of other factors, such as tryptophan, certain fractions of plasma proteins, nonionic wetting agents, and inorganic salts. No evidence was found for the involvement of -SH groups or for peroxide formation in the photodynamic process. 3,4-Benzpyrene, or its presumed water-soluble photodynamically active product, does not appear to be firmly bound in P. caudatum. (Author summary modified)
APTIC-22373

### PHOTOACTIVATION OF POLYNUCLEAR HYDROCARBONS.

Arch. Environ. Health, vol. 10:233-239, Feb. 1965. 24 refs. (Presented at the Air Pollution Medical Research Conference, 7th Annual Meeting, Los Angeles, Calif., Feb. 10-11, 1964.)
Samuel S. Epstein.
Identifiers: *Carcinogens, *Polynuclear compounds, *Photochemical reactions, Bio-assay, Microorganisms, Irradiation chambers, Benzopyrenes, Benzo (3-4)pyrene, Ultraviolet radiation, Reaction mechanisms.

Some incomplete studies are reviewed which include mechanisms of photodynamic toxicity of polynuclear carcinogens, correlation between photodynamic and carcinogenic activities, and the photodynamic bioassay of polynuclear atmospheric pollutants. Mixtures of motile ciliates and materials under test were incubated in dark, moist chambers and then continuously irradiated with long-wave ultraviolet light under direct observation on the stage of a stereoscopic microscope. Log-phase cells of cloned cultures of Paramecium caudatum provided the standard source of test cells, while selected studies were also performed on Tetrahymena pyriformis. With irradiation of benzo (a)pyrene-treated cells, mobility decreased progressively and became erratic until complete immobilization occurred. The cells became distorted and plump, and the surface membranes became elevated by translucent bleb, lysis finally occurring. Photodynamic effects of BaP involve a sensitized photo-oxidation as they can be abolished under conditions of anaerobiosis, and inhibited by a variety of anti-oxidants including butylated hydroxyanisole and alpha-tocopherol. Compounds which produce marked protective effects are mentioned. Simple tests for charge transfer complex formation in over 100 polynuclear compounds of wide structural range have revealed a positive but limited association between this property and photodynamic activity. Significant uptake and absorption of light were prerequisite but not sufficient for high photodynamic activity. If a compound falls in the category of high photodynamic activity, the odds that it is carcinogenic appear to be increased some four times. Data for the six crude benzene extracts tested showed a general pattern of correlation between apparent relative potencies, as determined by photodynamic bioassay, and BaP concentrations, as determined by chemical analysis. Photodynamic and chemical assay results are compared for 15 air samples.
APTIC-22377

### STUDIES IN THE U.S.S.R. ON THE DISTRUBUTION, CIRCULATION, AND FATE OF CARCINOGENIC HYDROCARBONS IN THE HUMAN ENVIRONMENT AND THE ROLE OF THEIR DEPOSITION IN TISSUES IN CARCINOGENESIS: A REVIEW.

Cancer Res., vol. 27:1132-1137, June 1967. 40 refs. (Presented at the International Cancer Congress, 9th, Tokyo, Japan, Oct. 1966.)
L. M. Shabad.
Identifiers: *Carcinogens, *Soils, *Benzopyrenes, Ussr, Streets, Urban areas, Engine exhausts, Microorganisms, Food and feed operations, Spectrometry, Fluorescence.

Spectrofluorescent methods were used for the quantitative determination of carcinogenic hydrocarbons at different stages of their distribution and circulation, both in animal organism and human environment. In active silt samples obtained from the sewage from a number of hydrolysis plants, 3,4-benzpyrene was discovered in quantities varying from 30 to 140 micrograms per kg of silt. Possible contamination of food with carcinogenic hydrocarbons is discussed and the measures for its prevention are planned. In soil samples collected near the sidewalk in one of the Moscow streets (about 500 cars per hour), 21,150 micrograms of 3,4-benzpyrene per kg of soil were found, while in the control sample taken from the soil of a nursery yard situated at a distance of several dozen meters from the same thoroughfare there were only 430 micrograms of BP per kg of soil. Methods of accurate quantitative determination of BP in exhaust gases were worked out, and quantities of exhausted BP were determined as a function of engine work. Soil pollution with benz (a)pyrene is described, with mention to the type of industrial source in the area. Microorganisms are present in soil contaminated with 3,4-benzpyrene which can both accumulate BP and also modify it considerably. BP and 7,12-dimthylbenz (a)anthracene-acetone solutions were treated by an ozone-air mixture and were destroyed completely within 2.5 minutes for BP and only 1 min for DMBA.
APTIC-22378

### THE DETECTION OF ETHYLKETEN AND ENOL-CROTONALDEHYDE IN THE VAPOUR-PHASE PHOTOLYSIS OF TRANS-CROTONALDEHYDE.

Chem. Commun., no. 4:190-191, Feb. 21, 1968. 4 refs.
J. W. Coomber, James N. Pitts Jr., and R. R. Schrock.
Identifiers: *Aldehydes, *Photolysis, Spectrophotometry.

Isomerisation to one or more unstable intermediates has been suggested as a means for electronically excited molecules to lose some of their energy and return to their ground state during photolyses. Using a long-path-length infrared spectrophotometer two such isomers, with very low quantum yields, have been identified during the photolysis of trans-crotonaldehyde. The isomers are ethylketen and enol-crotonaldehyde. It seems likely that enol-crotonaldehyde isomerises to crotonaldehyde and ethylketen is photolysed to propene and CO.
APTIC-22381

### ENERGY POOLING BY TRIPLET NITROGEN (A CUBED SIGMA SUB U PLUS) MOLECULES.

J. Chem. Phys., 50 (5):2256-2258, March 1, 1969. 12 refs.
D. H. Stedman, and D. W. Setser.
Identifiers: *Energy pooling, *Triplet nitrogen, Hydrocarbons, Nitrogen, Oxygen, Fluorescence, Ions, Gases, Liquids, Solids, Reaction kinetics.

Energy pooling by triplet aromatic hydrocarbon molecules by a process known as triplet-triplet annihilation gives delayed fluorescence in solid and liquid phases. Examples of energy pooling by long-lived, excited-electronic-state molecules in the gas phase is limited to singlet oxygen. The first conclusive evidence for gas-phase energy pooling by triplet molecules shown by the metastable nitrogen state are reported, and an estimate of the rate constant is given.
APTIC-22383

### MOLECULAR STRUCTURE AND PHOTOCHEMICAL REACTIVITY. XI. WAVELENGTH AND METHYL SUBSTITUENT EFFECTS IN THE PHOTOCHEMISTRY OF LACTONES IN THE LIQUID PHASE.

J. Am. Chem. Soc., 91 (1):108-112, Jan. 1, 1969. 18 refs.
R. Simonaitis, and J. N. Pitts Jr.
Identifiers: *Photochemical reactions, *Lactones, Aldehydes, Propanes, Ketones.

The photochemistry of gamma-butyrolactone is extended to alpha-methylbutyrolactone and gamma-methylbutryolactone to determine the effect of replacing a hydrogen atom of gamma-butyrolactone with a methyl group in the alpha and gamma positions on product quantum yields and excited-state lifetimes, and to determine the effect on product quantum yields with a change in wavelength from 2537 to 2380 A. A methyl group in the alpha position increases the formate quantum yield from 0.23 (allyl formate) to 0.39 (crotyl formate), and the cyclopropane quantum yield increases from 0.013 to 0.027, while the yield of the aldehyde products does not change. A methyl group in the gamma position decreases the lifetime of the excited state, but substitution in the gamma position has only a small effect. The change in wavelength from 2537 to 2380 A increases the yield of the dialdehydes, but does not change the quantum yield of formate or cyclopropane significantly. The possibility that this wavelength effect is due to vibrational effects in solution is discussed. (Author abstract modified)
APTIC-22384

### PERIODICITY IN ASCOSPORE DISCHARGE IN BOMBARDIA.

Trans. Brit. Mycol. Soc., 53 (3):449-454, 1969. 14 refs.
S. M. Pady, and C. L. Kramer.
Identifiers: *Spores, Diurnal.

Observations of spore discharge from the ascomycete, Bombardia fasciculate, in the field and under controlled laboratory conditions are presented. Diurnal periodicity in release of ascospores was observed. Discharge occurred at night with peaks between 10 pm and midnight. However, ascospores began to be discharged in the afternoon in both the field and growth chamber, suggesting an endogenous rhythm, which was confirmed by observations in continuous light and continuous dark. In terms of spore release, it seems that light is limiting at higher temperatures, while under colder conditions temperature seems to become the limiting factor. Similar interactions occur between light and humidity. (Author abstract modified)
APTIC-22385

### STUDY OF THE INFLUENCE OF SULFURIC ACID ON THE DEW POINT TEMPERATURE OF THE FLUE GAS.

(Beitrag zur Frage des Einfluesses der Schwefelsaeure auf die Rauchgas-Taupunkttemperature). Chem. Ing. Tech., 31 (5):345-350, 1959. 30 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 20p., Oct. 21, 1969.
Peter Mueller.
Identifiers: *Stack gases, *Humidity, *Sulfuric acid, Germany, Engine exhausts, Internal combustion engines, Gases, Vapors, Reaction kinetics, Thermodynamics, Pressure, Temperature.

The dew points of flue gases with small sulfuric acid concentrations are determined with the aid of thermodynamic relationships. The theoretical values obtained are compared with previous measured results. The dew point characteristics of a mixture of H2SO4 and water vapor at lowest partial pressure ratios are discussed. The presence of other gases in a flue gas will have no effect on dewing as long as they do not react with H2SO4. The dew point characteristics given are valid only in those conditions were equilibrium conditions are reached. How this agrees with reality is a question of condensation kinetics. The dew point problem in the cylinders of internal combustion engines has become more critical due to changes in fuel characteristics and a demand for higher longevity of the engines. Rapidly changing ther-

modynamic parameters within the cylinder make the problem more complex.
APTIC-22402

### ENTRAINMENT OF AIR INTO A LIQUID SPRAY.

Am. Inst. Chem. Engrs. J., 12 (4):708-717, July 1966. 21 refs.
Francis E. J. Briffa, and Norman Dombrowski.
Identifiers: *Sprays, *Aerodynamics, Great britain, Mathematical analyses, Flow rates, Liquids, Pressure.

The aerodynamic properties of sprays are significant in a wide range of applications; for example, in a combustion chamber, the burning characteristics of a fuel spray depends on both the manner in which the air is entrained and mixes with the spray, and on the final mixture ratio. The flow pattern existing in and around a flat spray was investigated, with emphasis on the region of disintegration of the liquid sheet. Fan spray nozzles were utilized; most of the experiments used isooctane as the test liquid at air velocities ranging from 23-155 cm/sec and differential ejection pressures from 7.6-118 lb/sq in. Room temperature air was the only ambient gas. Photographic techniques were used to determine liquid drop velocities, spray depth, and length of the liquid sheets. The mass of air entrained into the spray, the decay of air velocity along the spray axis, and the spread of the drops in the plane normal to that of the sheet are related to the operating conditions by equations theoretically derived and experimentally confirmed. Similarities between the characteristics of air entrainment into liquid sprays and into gas jets are noted. (Author summary modified)
APTIC-22439

### DESIGN CRITERIA FOR SMOG IRRADIATION CHAMBERS.

Preprint, California State Dept. of Public Health, Los Angeles, 11p., 1960. (Presented at the Conference on Methods in Air Pollution Studies, 4th, Los Angeles, Calif., Dec. 5-6, 1960.)
Frank Bonamassa.
Identifiers: *Design criteria, *Irradiation chambers, Costs, Glass, Plastics, Smog, Operating variables, Ultraviolet radiation.

The design of an irradiation chamber depends in general on the kind of experiment conducted and the space, personnel, and funds available. The source of ultraviolet irradiation may be natural sunlight, which is free but uncontrollable, or artificial light from either the traditional mercury arc or more recently developed types of fluorescent lamps. Cost, radiation characteristics, and type of chamber wall-and-window material required are among the factors governing the choice of light source. Small chambers can be constructed at nominal costs using any convenient Pyrex glass closed vessel, while large chambers are usually custom made and where more than 10,000 cu ft of space is needed, may require a well-constructed greenhouse. Choice of the proper chamber volume for a given experiment must take into consideration the two basic methods of chamber operation, static or dynamic. A rapid determination of the required size of a chamber can be made by using the Time Constant, the ratio of the chamber volume to the rate at which reacted air is to be removed from the system. The calculations for making these determinations are outlined.
APTIC-22454

### REVERSIBLE ACTIVATION OF COVALENT MOLECULES BY TRANSITION METAL COMPLEXES. THE ROLE OF THE COVALENT MOLECULE.

Accounts Chem. Res., vol. 1:335-344, Nov. 1968. 54 refs. (Presented at the International Conference on Coordination Chemistry, 10th, Tokyo and Nikko, Japan, Sept. 12-16, 1967.)
L. Vaska.
Identifiers: *Complexes, *Metal compounds, *Chemical reactions, Ethylene, Hydrogen, Carbon monoxide, Sulfur dioxide, Oxygen, Chemical bonds, Oxidation, Reaction kinetics, Thermodynamics, Pk.

Some quantitative data obtained in recent years on a few representative reversible activation reactions are summarized, mainly with hydrogen, oxygen, sulfur dioxide, carbon monoxide, ethylene, and substituted ethylenes, while a general hypothesis for these metal complex-gas interactions is presented. The objective in one study was to determine the role of the reacting gas by investigating a series of reactions of one metal complex with a variety of different addenda, and by comparing the kinetic, equilibrium, and thermochemical data of these different reactions and the electronic and geometric properties of the corresponding adducts. From carbonyl stretching frequencies and relative oxidation states of iridium in the adducts of complexes with some covalent molecules, the stability of the adduct appears to parallel the extent of electron transfer from the metal to the addendum. Electron-attracting power or acidity of the reacting molecule addendum is a function not only of its inherent electronic and symmetric properties but also of those of the particular metal complex, i.e., of the type and extent of the metal-addendum orbital overlap. Entropy changes for the reactions with oxygen and ethylene are about 20 eu more negative than those with carbon monoxide and sulfur dioxide, that one can conclude the type II complexes (O2 and C2H4 adducts) to be more constrained than the CO and SO2 adducts. Both the addition and reverse reactions of sulfur dioxide proceed much faster than those of the other gases with which it is compared. Hydrogen reacts about 20 times faster than oxygen, but the ratio of the reverse rate constants for the two reactions is only one-half of this value. Also, the pi-bonded addenda of type II show about equal reactivity, but the corresponding reverse reactions differ in their rate constants by four orders of magnitude. Bond polarity is also considered for the reversible activation of ethylene and substituted ethylenes.
APTIC-22460

### EFFECT OF INITIAL VELOCITY OF AN AEROSOL ON ITS TRAJECTORY IN A CURVILINEAR GAS FLOW.

(O vliyanii nachal 'noy skorosti aerozolya na trayektoiyu ego dvizheniya v krivolineynom gazovom potoke). Text in Russian. Inzh. Fiz. Zh., 15 (3):450-454, Sept. 1968. 5 refs.
Y. Ye. Maslov, V. D. Lebedev, and S. G. Ushakov.
Identifiers: *Aerosols, *Aerodynamics, *Flow rates, Ussr, Particle size, Mathematical analyses, Fluid flow, Temperature.

The effect of initial aerosol velocity on subsequent motion in a gas (air) flow with a velocity of 5-20 m/sec and aerosol particle size of 16.5-427 micron was studied in an annular ring at temperatures of 293-303 K. Sample trajectories are shown, and comparisons of calculated and experimental data are plotted. Theoretical curves were obtained using the Runge-Kutta four-point scheme as the computer algorithm for integration of the equations of motion; good agreement with experimental results was obtained.
APTIC-22472

### THE TERNARY SYSTEM K20-SO2-H20.

(Das ternaere System K20-SO2-H20). Text in German. Z. Elektrochem., 43 (5):302-304, 1937. 6 refs.
F. Hoelzl.
Identifiers: *Equilibrium, *Potassium compounds, *Sulfur dioxide, *Water, Europe, Oxides, Chemical reactions, Temperature.

Isothermal lines for the ternary system K20-SO2-H20 were determined experimentally at 0,11.5,25,33,40,65.3,80, and 100 C with chemically pure potassium hydroxide and carefully purified sulfur dioxide as starting materials in an inert atmosphere. Equilibrium was achieved by shaking rubber stoppered flasks for 36 hours in the water bath of a thermostat; samples were drawn after complete settling of the solid phase, and K20 was determined by volumetric or gravimetric analysis. At least 20 bivariant equilibrium determinations were made for each of the above temperatures. At higher temperatures, the tendency of SO2 to escape from acid solutions increased rapidly which rendered analytical results unreliable. The thus attained natural limit of the examined area corresponds at lower temperatures fairly precisely to the H2SO3 content of pure KHSO3 solutions and passes at higher temperatures into solutions with a lower SO2 content.
APTIC-22502

### OXIDATION OF SULFUR DIOXIDE IN FOG DROPLETS.

Illinois Univ., Urbana, Engineering Experiment Station, Contract SF-9, TR-2, 79p., April 1, 1956. 12 refs.
Donald R. Coughanowr.
Identifiers: *Absorption, *Fog, *Sulfur dioxide, *Reaction kinetics, Droplets, Simulation, Exposure chambers, Hydrogen, Manganese sulfates, Peroxides, Oxidation.

Determinations were made of the rate of absorption and oxidation of sulfur dioxide in fog droplets containing manganese sulfate from air saturated with water vapor. Fog-gas contact equipment is described, as well as the single drop technique. The exposure chamber was placed in a constant temperature bath and consisted of an equilibrium cell in which SO2 solution was allowed to come to equilibrium with the gas above the solution. The bubbler assembly for determining the SO2 concentration is also depicted. Droplet size was measured by a microscope with 60 power magnification. As a secondary problem, experiments were made to determine the kinetics of the reaction of sulfur dioxide and oxygen in solutions of manganese sulfate. For comparison with the rate of absorption of sulfur dioxide by droplets containing manganese sulfate, several experiments were made on the absorption of SO2 by quiescent droplets containing excess hydrogen peroxide. Results are in close agreement with the rate predicted by the theory for the absorption of a gas by spheres where the gas film resistance controls the rate and for which the modified Nusselt number is 2.0. The reaction of SO2 and oxygen in solutions of manganese sulfate follows a zero order mechanism with respect to both SO2 and O2; the rate is proportional to the square of the concentration of manganese sulfate. A small amount of sulfuric acid decreases the rate of reaction. The rate of absorption depends on the partial pressure of SO2 in the gas and the concentration of manganese sulfate in the droplet. The initial rate of absorption is high and decreases rapidly to a constant value. For concentrations of manganese sulfate between 250 and 1000 ppm, the rate of absorption of SO2 by droplets containing manganese sulfate is less than 10% of the rate of absorption by droplets containing an excess of hydrogen peroxide.
APTIC-22510

### A KINETIC STUDY OF SOME THIRD ORDER REACTIONS INVOLVING NITRIC OXIDE.

Pennsylvania State Univ., University Park, Dept. of Chemistry, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., June 1968, 162p. 61 refs.
Leo Zafonte.
Identifiers: *Nitric oxide (no), *Reaction kinetics, Infrared spectrometry, Bromine, Chlorine, Oxygen, Chemical reactions, Reaction mechanisms.

Third order reactions involving nitric oxide, oxygen, chlorine, and bromine are investigated in order to extend the concentration ranges over which these reactions had been studied; to determine more precise kinetic parameters; and to seek, for the infrared spectrum of any unstable reaction,

intermediates that may be present. Although no evidence for an unstable reaction intermediate in the third order reactions is found, that does not eliminate the possibility of a mechanism involving such an intermediate. Data indicate that the reactions can be explained by a simple termolecular mechanism. The reactions are followed by observing the optical density change in the infrared region with a spectrometer. (Author summary modified)
APTIC-22563

### INFLUENCE OF SURFACE-ACTIVE SUBSTANCES ON THE COAGULATION OF AEROSOLS.

Zap. Akad. Nauk SSSR, vol. 50:289-291, 1945.
Translated from Russian. Fort Detrick, Frederick, Md., 2p., July 1968. CFSTI, DDC: AD 682583
I. S. Artemov.
Identifiers: *Particle growth, *Surfactants, *Aerosols, Ussr, Adsorption, Organic acids, Phenols, Vapors.

A study is reported of the effect of phenol and oleic acid vapors on the coagulation of oil fog and stearic acid aerosols. The experimental conditions were such that no processes other than aerosol coagulation took place in the presence of foreign vapors. The possibility that the foreign vapor might influence aerosol formation was excluded by the thermal condensation of the aerosol in clean air. Aerosol sedimentation was avoided by using small intial concentrations of highly dispersed aerosol with particles sufficiently homogeneous in size. Condensation of the vapor was prevented by blowing it off the surface of a liquid in a closed vessel in a constant temperature chamber. Aerosol coagulation proceeded in the same way when the foreign vapors were present as when they were absent. This suggests that there can be no retardation of the speed of aerosol coagulation by adsorbed layers formed by surface-active substances around aerosol particles. However, retardation can be expected when adsorption or absorption of foreign vapors causes a marked change in the shape of aerosol particles.
APTIC-22564

### ADSORPTION AND SORPTION COMPLEXES FINAL TECHNICAL REPORT.

Imperial Coll. of Science and Technology, London (England), Contract DA-91-591-EUC-2465, 24p., June 1963. 5 refs. CFSTI: N63-23425
J. L. Whiteman.
Identifiers: *Adsorption, *Sulfur compounds, Great britain, Mathematical analyses, Aluminum silicates, Calcium compounds, Mercury compounds, Silver compounds, Sodium compounds, Ions, Reaction mechanisms, Pressure.

A study of the inclusion complexes formed by sulfur, phosphorus, and mercury in a number of zeolites is reported. The sorbents are regarded as continuous frameworks built by stacking together cages of various types. One such cage is the cubo-octahedron which has 14 faces; six are made from rings of four (Al,Si)04 tetrahedra and the remaining eight from rings of six such tetrahedra. Another structure-building unit is the hexagonal prism. In chabazite and gmelinite the anionic frameworks can be represented as sequences of layers of hexagonal prisms. Sulfur vapor adsorbed rapidly by the zeolites CaA and NaX. The uptake of the large cages in these zeolites is only about 75% of that expected from their volmes. This may be attributed to steric difficulties encountered in packing large molecules into the cages. The sulfur uptake of natural chabazite is comparatively slow and limited in extent. Phosphorus is also strongly adsorbed by NaX, but the approach to equilibrium is slow. Studies have been conducted on the mercury uptake of silver ion-exchanged zeolites. Large uptakes were recorded for the zeolites with the more open structures, and hysterisis loops were obtained. The saturation uptake of mercury is insufficient to completely fill the structure.
APTIC-22567

### DECOMPOSITION OF CARBONATES.

(Zersetsung von Carbonaten). CF III, p. 49-63, 1968. Translated from German. Belov and Associates, Denver, Colo., 20p., Feb. 3, 1970.
H. Juntgen.
Identifiers: *Carbonates, *Calcium compounds, *Sulfur dioxide, *Decomposition, Germany, Absorption (general), Hydroxides, Sulfites, Reaction kinetics, Reaction mechanisms, Thermodynamics, Heat capacity, Temperature.

Isothermal and nonisothermal measurements were obtained for the decompositions of various carbonates. There proved to be no systematic difference between the two measurements, the results corresponding instead to the different experimental conditions. In the isothermic experiments, the apparent value for the activation energy varied between 5 and 59 kcal/mol, according to to the variety and kernal size of the preparation and the experimental conditions (partial pressure of the carbon dioxide). The nonisothermic conditions also produced wide variations in apparent activation energy. The reaction parameters (composition, surface, and warmup speed for the carbonates tested) are presented in tabular form. Also discussed are the reactions of sulfur dioxide with calcium hydrate, calcium oxide, and calcium carbonate. The reaction of SO2 with the various Ca compounds always proceeds in the same temperature region with intensities that are different for each product. The hydrate assimilated the most SO2 and the oxide the least. The relatively low ability of the oxide to assimilate appears due to the formation of a sulfite layer impenetrable to gas on the kernal or crystal surface during the reaction. The hydroxide takes on more SO2 than the carbonate since the water separation begins at 300 C and extends over a wider temperature range. Individually, the capability of SO2 for assimilation also depends on SO2 partial pressure, the kernal size and surface of the material introduced, and warmup speed.
APTIC-22586

### EXPERIMENTS FOR THE DETERMINATION OF REACTION KINETIC MAGNITUDE FOR THE ISOTHERMAL PYROLYSIS OF BITUMINOUS COAL.

(Versuche zur Bestimmung reaktionskinetischer Grossen bei der isothermen Steinkohlen-Pyrolysis). Chem. Fabrik, 40 (7):317-364, April 10, 1968. 11 refs. Translated from German. Belov and Associates, Denver, Colo., 26p., May 22, 1970.
H. Luther, G. Bergmann, and T. N. Sreenivasan.
Identifiers: *Coal, *Pyrolysis, *Reaction kinetics, Germany, Coal characteristics, Methanes, Hydrogen, Reaction mechanisms, Pressure, Temperature.

Formation of methane, ethane and hydrogen were observed volumetrically and by means of gas chromatography during isothermal pyrolyses of bituminous coal, vitrinite and exinite in a vacuum between 400 and 500 C. The constants of speed of reaction, activation energies (40 to 65 kcal/mol) and perturbation factors of the individual reaction stages were calculated from the values measured according to the method of the least square deviations. The gas formation curves which were measured non-isothermally were analyzed with the kinetic values found. A comparison with kinetic data found by various experimental methods showed essentially good agreement. While the formation curves for the total amount of gas, methane and hydrogen were quite similar to each other, the curve for the formation of ethane deviated noticeably. Values for methane and hydrogen which are approximately equal indicate that the formation of these gases takes place according to the same reaction mechanism, but the mechanism for ethane formation is yet to be investigated. The appendix describes the fitting of a curve on data points by linear or non-linear regression and iterative calculation by the method of steepest descent.
APTIC-22587

### A COMPARISON BETWEEN STATISTICAL MODEL AND LINE BY LINE CALCULATION WITH APPLICATION TO THE 9.6-MICRON OZONE AND THE 2.7-MICRON WATER VAPOR BAND.

Appl. Opt., 7 (6):1167-1177, June 1968. 16 refs.
CFSTI, DDC: AD 676963
Aharon Goldman, and Thomas G. Kyle.
Identifiers: *Mathematical modeling, *Infrared spectrometry, *Ozone, *Water, Absorption, Statistical analyses, Vapors.

The absorption spectra of many infrared bands can be computed on large computers using line by line calculations. Tables of line parameters that are available for several ir bands enable one to calculate the monochromatic transmittance for arbitrary pressure and path length and then to degrade the spectrum using an appropriate split function. Also, from the same individual line parameters, the statistical band model spectral parameters can be calculated. The absorption spectrum is then computed for arbitrary pressure and path length. A satisfactory agreement between the two methods indicates that the band model fits the absorption band in question. The present study performed such comparisons for the 2.7-micron water band and the 9.6-micron ozone band. The already known statistical character of the water vapor band was confirmed. The statistical model fit the 9.6-micron ozone band, despite earlier findings to the contrary. The agreement between the two methods was good for the square slit function but not for the triangular slit function. However, the agreement between the methods was much better than the agreement of either of them with experimental data. This indicates that a refinement of line parameters is needed.
APTIC-22589

### PENETRATION OF AIR JETS ISSUING FROM CIRCULAR, SQUARE, AND ELLIPTICAL ORIFICES DIRECTED PERPENDICULARLY TO AN AIR STREAM.

National Advisory Committee for Aeronautics, Cleveland, Ohio, Lewis Flight Propulsion Lab., TN-2019, 18p., Feb. 1950. 2 refs.
Robert S. Ruggeri, Edmund E. Callaghan, and Dean T. Bowden.
Identifiers: *Aerodynamics, *Flow rates, Density.

An experimental investigation was conducted to determine the penetration of air jets directed perpendicularly to an air stream. Jets issuing from circular, square, and elliptical orifices were investigated and the jet penetration at a position downstream of the orifice was determined as a function of jet density, jet velocity, air-stream density, air-stream velocity, effective jet diameter, and orifice flow coefficient. The jet penetrations were determined for nearly constant values of air-stream density at three tunnel-air velocities and for a large range of jet velocities and densities. The results were correlated in terms of dimensionless parameters and the penetrations of the various shapes were compared. Greater penetration was obtained with the square orifices and the elliptical orifices having an axis ratio of 4:1 at low tunnel-air velocities and low jet pressures than for the other orifices investigated. The square orifices gave the best penetrations at the higher values of tunnel-air velocity and jet total pressure. (Author abstract)
APTIC-22604

### MASS AND MOMENTUM TRANSFER IN A SOLID-LIQUID SYSTEM. FIXED AND FLUIDIZED BEDS.

Ind. Eng. Chem., 41 (6):1124-1134, June 1949. 9 refs.
Leroy K. McCune, and Richard H. Wilhelm.
Identifiers: *Mass transfer, *Fluidized beds, *Momentum transfer, Particulates, Particle shape, Particle size, Adsorption, Heat transfer, Liquids, Solids, Flow rates, Pressure, Temperature.

Mass transfer between an upward stream of liquid and solid particles in consolidated and in ex-

panded, fluidized beds is considered. The solid particles in question were 2-naphthol and the liquid was water. The mass transfer results are applicable equally well to heat transfer under similar physical circumstances. Mass transfer is a component mechanism in liquid phase catalytic processes, in leaching and adsorption operations, and in exchange processes such as occur in resin columns. The experimental technique involved partial dissolution of spherical and flake-shaped particles of difficultly soluble 2-naphthol in a rising stream of water. A precise analytical technique was developed for measuring the small concentrations of 2-naphthol in the exit stream involving dye formation and colorimetric analysis. The measured variables were water flow rate, exit concentration, water temperature, particle and bet characteristics, and pressure drop. From these data, correlating variables including J factor, Reynolds number, friction factor, and drag coefficient were interrelated. The range of experimental and correlative variables includes particle shape, particle size, Reynolds number, degree of expansion in fluidized beds, Schmidt group, bed diameter, and consolidated bed depth. The correlated results concerning mass transfer and friction in fixed and fluidized beds are discussed and compared. The importance of fraction void and the effect of nonuniformity of flow pattern as unifying relationships for mass transfer in fixed and fluidized bed and for single particles are discussed. Mass transfer per unit pressure drop in fixed and fluidized beds is also considered. (Author abstract modified)
APTIC-22605

### THE FLUX OF POLYCYCLIC AROMATIC HYDROCARBONS AND OF INSOLUBLE MATERIAL IN PRE-MIXED ACETYLENE-OXYGEN FLAMES.

Combustion Institute, Pittsburgh, Combust. Inst. Twelfth International Symposium on combustion, Poiters Univ., France, July 1968, p. 625-634. 15 refs.
E. E. Tompkins, and Ronald Long.
Identifiers: *Acetylenes, *Polynuclear compounds, *Oxygen, *Combustion, *Flow rates, Great britain, Temperature.

The mass flux of total polymeric material, soluble material, insoluble material and polycyclic aromatic hydrocarbons (p.c.a.h.) was determined at different heights above a flat-flame burner on which acetylene-oxygen flames were stabilized at 20 mm mercury pressure. The acetylene-oxygen ratios used were 1.2, 1.5, and 1.8, respectively. The mass flux reaches a maximum early in the flame just beyond the bluegreen zone and then undergoes an initially rapid decline; the flux of insoluble material becoming constant while that of p.c.a.h. shows an appreciable increase higher in the flame. The physical appearance of the material collected from the flame by isokinetic sampling through a water-cooled stainless-steel funnel suggests that a polymer-like material is first formed which then undergoes carbonization with dehydrogenation higher in the flame. The p.c.a.h. are formed in two distinct regions of the flame; in a region where the temperature is rising (they are then destroyed to an appreciable extent in the highest temperature region and, in a secondary zone much higher in the flame where the temperature is falling over the approximate range 900-650 C, presumably by pyrolysis of residual acetylene. The majority of the p.c.a.h. (identified by programmed temperature gas chromatography combined with uv spectrophotometry) are devoid of side-chains--e.g., methyl groups--and are probably the relatively unreactive ones.
APTIC-22609

### TABLES OF DRIFT VELOCITIES OF SLOW ELECTRONS IN HELIUM, NEON, ARGON, KRYPTON, XENON, HYDROGEN, DEUTERIUM, NITROGEN, CARBON MONOXIDE, CARBON DIOXIDE, WATER VAPOR, NITROUS OXIDE, AND AMMONIA.

Westinghouse Research Labs., Pittsburgh, Pa., Dept. of Physics, ONR Contract NONR 2584 (00), ARPA Order 125-61 (Amd. 4), Proj. 7200, TR-13 WRL RR-62-928-113-R1, 21p., July 23, 1962. 2 refs. CFSTI, DDC: AD 703627
J. L. Pack, R. E. Voshall, and A. V. Phelps.
Identifiers: *Gases, *Drift velocities, *Slow electrons, Ammonia, Hydrogen, Nitrogen, Carbon dioxide, Carbon monoxide, Nitrous oxide (n20), Water, Vapors, Electric charge, Temperature.

The drift velocities of electrons in various gases are presented in tabulated form. The drift velocities were measured in helium, neon, argon, krypton, xenon, hydrogen, deuterium, nitrogen, carbon monoxide, carbon dioxide, water vapor, nitrous oxide, and ammonia for E/p values from 10 to the minus 4th power to 30 volts/ cm-mm Hg at several gas temperatures between 77 K and 443 K. In all gases except neon measurements were extended to low enough E/p such that the electrons were in thermal equilibrium with the gas. A discussion of the experimental procedure is included. (Author abstract modified)
APTIC-22681

### KINETIC STUDY OF THE GAS-PHASE REACTION C-C5H10 + I2 AND ITS REVERSE C-C5H8 + 2HI. THE HEAT OF FORMATION OF CYCLOPENTYL RADICAL.

Intern. J. Chem. Kinet., vol. 2:83-92, March 1970. 19 refs.
Shozo Furayama, David M. Golden, and Sidney W. Benson.
Identifiers: *Pentenes, *Pentanes, *Reaction kinetics, Iodinated hydrocarbons, Hydrogenation, Reaction mechanisms, Temperature, Thermodynamics.

The kinetics of the gas-phase dehydrogenation of cyclopentane to cyclopentene is consistent with a slow attack by an iodine atom on cyclopentane in the range 282-382 C. The measured rate constants fit an Arrhenius equation. A bond dissociation energy relationship signifies that cyclopentane and the cyclopentyl radical have the same strain energy. Arrhenius parameters are deduced for all six steps in the reaction mechanism. Surface reactions are shown to be unimportant. Cyclopentyl iodide is an unstable intermediate in the reaction; the rate constant for its bimolecular formation is determined. Experiments are conducted using spectrophotometric techniques. (Author abstract modified)
APTIC-22704

### STUDY OF DECOMPOSITIONS CAUSED BY SIMULTANEOUS SEPARATIONS OF SEVERAL GASES. I. THERMAL DECOMPOSITION OF HYDRATED ZINC SULFITE, ZNSO3, 5/2 H2O.

(Etude de decompositions s'effectuant avec departs simultanes de plusieurs gaz. 1. Decomposition thermique du sulfite de zinc hydrate ZnSO3, 5/2 H2O). Text in French. Bull. Soc. Chim. France, vol. 8:1749-1756, 1964. 18 refs.
Guy Pannetier, Gerald Djega-Mariadassou, and Jean-Marie Bregeault.
Identifiers: *Zinc compounds, *Sulfites, *Decomposition, *Temperature, France, Chromatography, Infrared spectrometry, Oxides, Sulfates.

Thermal decomposition of hydrated zinc sulfite between 15 and 1000 C is examined by thermogravimetry, differential heat analysis, radiocrystallography, and infrared spectrometry. The gaseous products of the reaction were subjected to binary and chromatographic analyses, with the aid of a differential heat analysis apparatus. The 5/2 hydrate decomposes to the 1/2 H2O form, then to the anhydrous salt, the oxysulfite, the basic sulfate, and finally the simple oxide (ZnO). The 'X' diagrams of the hydrated sulfites are drawn, and the tag for the anhydrous ZnSO3 is confirmed. Infrared spectrometry suggests the presence of a rather deformed pyramidal group that varies according to the compound under consideration.
APTIC-22716

### MOMENTUM INTEGRAL THEORY FOR GAS PARTICLE FLOW.

Cincinnati Univ., Ohio, Dept. of Aerospace Engineering, ARO Contract DAHCO4-69-C-0016, Proj. THEMIS Rept. 69-3, 39p., Sept. 1969. 5 refs. CFSTI, DDC: AD 696442
A. Hamed, and W. Tabakoff.
Identifiers: *Particulates, *Flow rates, *Gases, Particle size, Mathematical analyses, Density.

A theoretical analysis for laminar boundary layer in gas particle mixtures is carried out. The momentum integral equations are derived, for the general case of laminar boundary layer, in the presence of pressure gradient. The case of a gas particle mixture flow over a flat plate with both phases having the same velocity in the free stream is studied in detail. The curves representing the gas boundary layer thickness, the shear stress at the wall, the gas velocity profile shape factor, and the particle displacement thickness, are presented for various particle concentrations in the free stream, different values of particle diameters and different values of solid particle material densities. The gas velocity profile shape factor is always positive. This means that the introduction of particles moving with the same velocity in the gas flow over a flat plate, has a similar effect on the gas velocity distribution in the boundary layer, as that of negative pressure gradient. It is clear from its definition that it becomes very large for small particle diameters; in addition it is large for small values of solid particle material densities and for high particle concentration in the free stream.
APTIC-22718

### ADVANCES IN THE MECHANICS OF AEROSOLS.

(Uspekhi mekhaniki aerozoley). Akademii Nauk SSSR, Moscow, 1961, 159p. 415 refs. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., 192p., May 24, 1968. CFSTI, DDC: AD 682062
N. A. Fuks.
Identifiers: *Aerosols, *Control equipment, Ussr, Sampling methods, Centrifugal separators, Electrostatic precipitators, Filters, Filter fabrics, Diffusion, Transport, Convection (atmospheric), Winds, Precipitation, Turbulence (atmospheric), Brownian movement, Heat transfer, Particle growth, Dispersions.

Material pertaining to the mechanics of aerosols published between 1954 and 1959 is reviewed. In addition, a small number of earlier works omitted from the previous issue of this book (1955) are included. Subjects covered include dimensions and form of aerosol particles, uniform rectilinear movement, nonuniform rectilinear movement, curvilinear-rectilinear movement, Brownian movement and diffusion, turbulent diffusion, coagulation, thermal and diffusion transport, centrifuges and cyclones, inertial precipitation, electrostatic precipitation, aerosol sampling, filters and aerosol filtering, and transition of powders into an aerosol.
APTIC-22721

### FUSED SALT MIXTURES AS REACTION MEDIA.

Ind. Eng. Chem., 36 (5): 329-332, May 1944. 4 refs.
H. F. Johnstone, and W. E. Winsche.
Identifiers: *Sulfur dioxide, *Reaction mechanisms, *Fused salts, Particle size, Chlorides, Iron compounds, Sodium chloride, Titanium compounds, Zinc compounds, Iron oxides, Oxygen, Reaction kinetics, Temperature.

The reaction of sulfur dioxide and air with inorganic materials suspended or dissolved in fused salt media is studied. Ferric oxide suspended in fused sodium chloride-ferric chloride reacts at 400

C with sulfur dioxide and oxygen to form insoluble ferric sulfate. The rate of reaction is determined by both diffusional and chemical resistances. Ilmenite suspended in fused sodium chloride-ferric chloride reacts above 530 C with a preferential attack on the iron constituent. The beneficiated titanium dioxide can be recovered in the same particle size as the original ilmenite. Zinc oxide suspended in fused sodium chloride-zinc chloride reacts with sulfur dioxide and oxygen at a negligibly slow rate in the range from 430 to 530 C, as does sodium chloride in fused sodium chloride-sodium sulfate at 700 C. (Author abstract modified)
APTIC-22723

### STATISTICAL BAND MODEL PARAMETERS AND INTEGRATED INTENSITIES FOR THE 5.9 MICRON, 7.5 MICRON, AND 11.3 MICRON BANDS OF HNO3 VAPOR.

Denver Univ., Colo., Physics Dept. and Denver Univ., Colo., Chemistry Dept., OAR Contract F19628-68-C-0233, Proj. 8662, ARPA Order 363, SR-7, 47p., Jan. 1970. 11 refs. CFSTI, DDC: AD 703739
Aharon Goldman, Thomas G. Kyle, and Francis S. Bonomo.
Identifiers: *Mathematical modeling, *Infrared spectrometry, *Nitric acid, Spectrophotometry, Vapors.

The presence of nitric acid in the atmosphere above 20 km was discovered by means of infrared absorption. Laboratory measurements duplicating the original absorptions are described. Quantitative absorption measurements of the 5.9 micron, 7.5 micron, and the 11.3 micron bands of pure nitric acid vapor were carried out at 40 C. Absorption cells of various lengths were used in order to obtain curves of growth. The statistical spectral band model was applied and band model parameters and integrated intensities were derived. (Author abstract modified)
APTIC-22730

### TWO CASES OF DROPLET EVAPORATION IN A FLOW OF HOT GAS.

(O dvukh sluchayakh ispareniya kapli v potoke goryachego gaza). Text in Russian. Zh. Prikl. Khim., 42 (2):447-449, 1969. 6 refs.
R. S. Kuznetskiy, and M. K. Likht.
Identifiers: *Evaporation, *Droplets, *Fluid flow, *Drying, Ussr, Particle size, Mathematical analyses.

Reduction in diameter and horizontal motion of a spherical droplet during evaporation in a uniform horizontal flow of hot gas is examined theoretically taking into account Stokes forces and assuming near-equilibrium evaporation (i.e., low gas velocity). Cases of high and low Reynolds number are treated separately to derive time and position dependences for droplet radius.
APTIC-22760

### TEMPERATURE DEPENDENCE OF RESISTANCE AND CRYSTALLIZATION PROCESSES IN THE BINARY SYSTEM SELENIUM-SULFUR.

(Temperaturnaya zavisimost' soprotivleniya i kristallizatsionnyye protsessy v dvoynoy sisteme selen-sera). Text in Russian. Uch. Zap. Leningrad. Gos. Pedagog. Inst. im. A. I. Gertsena, vol. 303:221-229, 1966. 18 refs.
I. A. Aleksandrovich.
Identifiers: *Selenium compounds, *Sulfur compounds, *Crystal structure, *Electrical resistance, Ussr, Temperature.

Experimental studies showed that the addition of less than 10 at % sulfur reduces the electrical resistance of crystalline selenium, while with quantities greater than 10 at %, an increase in resistance results. Addition of large amounts of sulfur also noticeably narrows the temperature range over which the selenium-sulfur mixture can occur in the crystalline state. The presence of sulfur in amounts of 5% or more both reduced the rate of crystallization and increased sharply the time required for total crystallization of the specimens.
APTIC-22763

### THE CATALYTIC OXIDATION OF SULFUR DIOXIDE WITH VANADIUM CATALYST.

(Banajiumu syokubai ni yoru aryusangasu sessyoku sanka hanno kiko). Kogyo Kagaku Zasshi (J. Chem. Soc. Japan), 63 (1):56-59, 1960. 7 refs. Translated from Japanese. Franklin Inst. Research Labs., Philadelphia, Pa. Science Info. Services, 12p., Nov. 18, 1969.
Hareichi Hara, Akiyoshi Adachi, and Naojii Kurata.
Identifiers: *Catalytic oxidation, *Vanadium compounds, *Sulfur dioxide, *Reaction mechanisms, Japan, Catalysts, Reaction kinetics, So2 removal (combustion products).

Hougen and Watson's formulas describing catalytic oxidation kinetics were applied to an evaluation of the mechanism of the oxidation of sulfur dioxide by a vanadium catalyst. Conclusions of the study are that the rate-determining step of the reaction is the surface reaction between SO2 and the oxygen atom, both adsorbed on the active points of the catalyst. Adsorbed SO2 plus adsorbed 0 equals SO3 adsorbed at 440-550 C. The physical meanings of the constants included in a derived velocity formula are discussed. (Author abstract modified)
APTIC-22773

### THERMAL DECOMPOSITION OF SOME METALLIC SULFITES. II. SULFITES OF ZINC, CADMIUM, AND MANGANESE.

(Decomposizione termica di alcuni solfiti metallici. Nota II. Solfiti di zinco, cadmio e manganese (II)). Text in Italian. Gaz. Chim. Ital., vol. 92:174-188, 1962. 9 refs.
Mario Cola, and Silvio Tarantino.
Identifiers: *Sulfites, *Chemical reactions, *Temperature, Italy, Cadmium compounds, Manganese compounds, Zinc compounds, Decomposition, Oxidation, Reduction.

The sulfites of zinc, cadmium, and manganese (valence 2) were heated in an inert atmosphere and in a closed environment; the result was a dissociation and a disproportionation reaction. The two reactions are accompanied by side reactions when MnSO3 is heated under atmospheric pressure. The tendency toward disproportionation increases in proportion to the basicity of the metal, which agrees with results obtained in experiments with other sulfites of closely related metals.
APTIC-22774

### DYNAMICS OF BILATERALLY SYMMETRIC VORTEX RINGS.

Polytechnic Inst. of Brooklyn, Farmingdale, N. Y., Dept. of Aerospace Engineering and Applied Mechanics, AFOSR Contract AF 49 (638)-1623, Proj. 9781-01, Rept. AFSOR 69-2156TR, PIBAL Rept. 69-37, 115p., Sept. 1969. 25 refs. CFSTI, DDC: AD 697815
Hermann Viets, and Pasquale M. Sforza.
Identifiers: *Vortex rings, *Hydrodynamics, Flow rates.

An investigation to predict the dynamics of vortex rings of bilaterally symmetric shape is reported. The induced velocity at each point on the vortex ring is found by the Biot-Savart Law with an averaging procedure to eliminate the infinite velocity discontinuity which arises due to the application of the law. Once the induced velocity is found, it is related to the motion of the ring by two different methods. A hydrodynamic vortex ring moves with the same velocity as the local fluid. In a Rankine vortex ring, the induced velocity gives rise to a relative velocity on the ring and results in lift and drag forces on the ring. The ring then distorts under the influence of these forces. Experimentally, vortex rings are produced by pulsing some dyed fluid through a rectangular orifice. The rings thus produced oscillate about a circular shape. This method does not permit the determination of the initial conditions of position and velocity. Another method involves starting the vortex behind an airfoil. Ringwings of various shapes are built with airfoil cross-sections. Dye is deposited at the trailing edge of the ringwing by the use of a fluid which changes color in the vicinity of an electrode when current is passed through it. When the ringwing is accelerated, visible vortex is generated behind it. The initial conditions on this ring are easily specified as the shape of the ringwing and zero velocity. Qualitative agreement between theory and experiment was excellent. However, quantitative comparison was not possible because the core size of the vortex and the strength of the circulation were unknown. The difference between the two methods of treating the vortex motion appears to be the time scale of the problem. However, the time scale also depends upon the choice of the numerical value of the circulation.
APTIC-22817

### ATMOSPHERIC CONTAMINATION AND TRIBO ELECTRIFICATION. (FINAL REPORT).

Georgia Inst. of Tech., Atlanta, Engineering Experiment Station, NAPCA Grant AP00741-02, Proj. B-366, 39p., 1970. 13 refs.
Edward E. Weaver, and Clyde Orr Jr.
Identifiers: *Tribo electrification, *Gases, Platinum, Humidity, Hydrochloric acid, Water, Vapors, Electric charge, Voltage.

Tribo (frictional) electrification between various substrates and platinum is investigated to determine the effects of humidity and gaseous pollution and to investigate the mechanisms of frictional charging. Results confirm that, in pure air, water vapor exerts a predominant influence on electrostatic charging. Most pollutant gases have only a small effect on the voltage generated. However, hydrogen chloride reduces the voltage to zero. No gases cause an increase in tribo electrification. Theories which might apply to the results include the contact potential theory, ion transfer, charge separation, chemical reaction between the adsorbed gas and the solid involving frictional catalysis, and piezoelectric generation due to adsorbed layer molecular distortion. Piezoelectric generation of charges due to the forces applied on adsorbed, dielectric molecules and their resulting distortion is probably the most significant source of charging under low surface coverage conditions. (Author abstract modified)
APTIC-22863

### APPLICATION OF THE RADIOACTIVE TRACER METHOD IN INVESTIGATION OF THE EFFECTIVENESS OF AIR MIXING IN VENTILATED ROOM.

Nukleonika (English translation from Polish of Nukleonika), 13 (9):67-70, 1968. 3 refs. CFSTI: TT 68-50011/9
Wlodzimierz Dzik, Wlodzimierz Fiszer, and Waldemar Kempinski.
Identifiers: *Buildings, *Ventilation, *Simulation, *Radioactive tracers, Europe, Diffusion, Fluid flow, Isotopes, Water, Temperature.

Experiments were carried out with water-filled models in which nonisothermal streams of water, containing a radioactive isotope as tracer, were blown into models of rooms with dimensions corresponding to those of typical offices in order to study the effects of the thermal properties of the incoming stream and premises on the effectiveness of air mixing in ventilated rooms. The scales of these dimensions and of the physical values of the air were determined theoretically. The positions of the inlet and outlet orifices and the temperature of the inlet stream and of the water filling the model were varied. Temperature differences between the stream and the medium do affect the mixing process. The experimental apparatus is

judged suitable for varying the parameters involved in the ventilating process; and the use of models having a water medium makes it possible to use different radioactive isotopes which can, after completion of the experiment, be recovered with an appropriate ion exchanger.
APTIC-22881

### FLOW OF A CIRCULAR JET INTO A CROSS FLOW.

J. Aircraft, 6 (3):283-284, May-June, 1969. 9 refs.
P. T. Wooler.
Identifiers: *Mathematical analyses, *Plume behavior, *Engine exhausts, *Jet aircraft, Aircraft, Winds, Flow rates.

To achieve vertical or short take off and landing (VSTOL) in airplanes through use of lift engines or fans, it is necessary to determine the flowfield due to a jet exhausting at right angles into a uniform cross flow. To predict this flowfield, it is necessary to know the position of the jet centerline. A simple equation is derived for centerline calculations which fits experimental data quite well.
APTIC-23363

### THERMAL DECOMPOSITION OF CARBON OXYSULFIDE.

(Die Zersetzung des Kohlenoxysulfides in der Waerme). Text in German. Chem. Ber., vol. 52:681-694, 1919. 10 refs.
Alfred Stock, and Paul Seelig.
Identifiers: *Decomposition, *Carbon oxysulfide, Germany, Organic sulfur compounds, Carbon dioxide, Carbon monoxide, Sulfur dioxide, Sulfides, Carbon disulfide, Flow rates, Temperature.

Carbon oxysulfide (COS) is subject to several decomposition reactions. The CO reaction forms carbon monoxide and elemental sulfur. The CO2 reaction forms carbon dioxide and carbon disulfide. There is also a third equilibrium reaction between CO and S2 on the one hand and CO2 and CS2 on the other. The authors conducted four series of experiments in thermal decomposition, the first 3 series at 800 C and the 4th at 950, recording the rate of flow of the gases evolved for various heating and cooling periods and their content of CO2, CS2, COS, and CO. The degree of dissociation (as percentages) of CO and CO2 are also given.
APTIC-23366

### ON THE FLOW PAST A CIRCULAR JET EXHAUSTING AT RIGHT ANGLES FROM A FLAT PLATE OR WING.

J. Roy. Aeron. Soc. (London), 71 (675):216-218, March 1967. 9 refs.
P. T. Wooler.
Identifiers: *Plume behavior, *Aerodynamics, *Fluid flow, Aircraft, Mathematical analyses.

A semi-empirical method for predicting the aerodynamic interference of an exhausting jet on a uniform mainstream flow past a wing or flat plate is presented. The method is particularly applicable to vertical or short take-off and landing aircraft. The calculations obtained compare favorably with experimental data for wings as well as for the pressure field on a plane wall. The only difference between theory and experiment is in the wake area downstream from the jet, where the results differ considerably. It is possible that the mainstream separates around the jet leaving a wake region on a plate surface, the effect of which is to produce an appreciable suction force on the plate, a phenomenon which has not yet been accounted for when determining the circulation effect of the jet.
APTIC-23382

### REACTION OF NITROGEN DIOXIDE WITH POLYSTYRENE FILMS.

J. Polymer Sci., 5 (A-1):3214-3218, 1967. 8 refs.
H. H. G. Jellinek, and Y. Toyoshima.
Identifiers: *Styrenes, *Nitrogen dioxide (no2), *Oxidation, Synthetic rubber, Flow rates, Reaction kinetics, Reaction mechanisms, Thermodynamics.

The reaction of nitrogen dioxide gas with polystyrene films is studied from the standpoint of main-chain rupture. The films are exposed to a range of NO2 concentrations, times, temperatures, and pressures. After exposure, the intrinsic viscosities of the films are determined in benzene solutions. The reaction of NO2 gas with polystyrene may be formulated on similar lines as the thermal and oxidative bulk degradation of polystyrene and the reaction of NO2 gas with polyethylene, which was investigated by determining infrared spectra as functions of time and temperature. The initiation reaction is assumed to consist of the reaction of NO2 with an alpha-hydrogen atom to form a polymer radical. The reaction rates and mechanisms are described.
APTIC-23399

### EVALUATION OF FREE SILICA IN STONE DUSTS WITH SPECIAL REFERENCE TO CHEMICAL METHODS--A REVIEW.

J. Mines Metals Fuels, 16 (11):413-417, Nov. 1968. 26 refs.
K. C. Jayaprakas, and H. K. Ganguly.
Identifiers: *Quartz, *Dusts, *Chemical methods, Asia, Coal, Silicon compounds.

Stone dusting is an effective method of combatting the coal dust hazard, but it is important for the dust to have a low free silica content. Prolonged inhalation of fine quartz dust can lead to silicosis. The methods for determining free silica in the presence of other silicates can be classified as either physical or chemical. Major methods are X-ray analysis and differential thermal analysis. An indirect chemical method is the analysis of rock samples for their constituent elements. Other important chemical methods employ hydroflusilicic acid, hydrofluoboric acid, and phosphoric acid as reagents, or involve the fusion or rock samples with potassium or potassium fluoborate. Through the X-ray method is accurate and reliable, chemical methods are preferred because of low capital and maintenance costs. The phosphoric acid method has certain advantages over other chemical methods in that a 14-min treatment will almost completely dissolve most silicates. The method gives reasonably accurate and reproducible results. The solubility of quartz (-200 mesh) for a treatment time of 14 min is 1.4% of the quartz.
APTIC-23406

### THE WAVELENGTH DEPENDENCE OF THE PRIMARY PROCESSES IN THE PHOTOLYSIS OF SULFUR DIOXIDE.

Preprint, Ohio State Univ., Columbus, Dept. of Chemistry, 14p., 1969. 11 refs.
T. Navaneeth Rao, and Jack G. Calvert.
Identifiers: *Sulfur dioxide, *Photolysis, *Phosphorescence, Quenching, Fluorescence, Reaction kinetics, Reaction mechanisms.

Measurements of fluorescent and phosphorescent yields of sulfur dioxide at 265O, 2750, 2963, and 3020 A were made on an absolute spectrophosphorimeter. Light absorption by sulfur dioxide at each of the wavelength regions followed the Beer-Lambert law well. The apparent extinction coefficients are as follows: 2650 A, 86.5; 2750 A, 154; 2963 A, 180; 3020 A, 120 l/mole Ocm. The rate constants of ratios of quantum yield of phosphorescence to that of fluorescence at each wavelength are summarized and compared with previous estimates. The results of the present work support the contention that internal energy dissipation in sulfur dioxide can compete favorably with fluorescence emission even in the limit of zero pressure. Apparently the extent of coupling which occurs between vibronic levels of single state sulfur dioxide and the ground state sulfur dioxide molecule is sufficiently great to overrride the intrinsic low density of states in this molecule. It is noted that the addition of low concentrations of biacetyl quenched the triplet sulfur dioxide molecule effectively without serious depletion of the singlet molecule concentration and that there appeared to be little wavelength dependence of the fraction of singular state sulfur dioxide which forms triplets on undergoing a quenching collision with sulfur dioxide.
APTIC-23414

### CHAIN SCISSION OF BUTYL RUBBER BY NITROGEN DIOXIDE IN ABSENCE AND PRESENCE OF AIR.

J. Polymer Sci., vol. 8 (A-1):711-726, 1970. 9 refs.
J. J. G. Jellinek, and F. Flajsman.
Identifiers: *Synthetic rubber, *Nitrogen dioxide (no2), *Oxidation, Reaction kinetics, Reaction mechanisms, Thermodynamics, Pressure, Temperature.

The chain scission reaction suffered by butyl rubber due to nitrogen dioxide (0.1-1 mm Hg) was studied in the presence and absence of air and also as a function of temperature (25-65 C) at constant NO2 pressures, again the absence and presence of 1 atm of air. Plots of the degree of degradation vs. time for various NO2 pressures show curves characterized by an initially fast rate of chain scission, which decreases rather abruptly after about 5-10 hr. The rates increase with increasing NO2 pressure, temperature, and in the presence of air. The data indicate the initial presence in the polymer molecule of some structures which are more susceptible to chain scission than the normal structures. However, the abnormal structures exist in only very small amounts and on degradation become quickly exhausted. These 'weak links' in a polymer molecule are assumed to be some oxygenated structures in the isoprene or some residual catalyst fragments. All the experimental data are in satisfactory agreement with proposed reaction mechanisms of chain scission in butyl rubber.
APTIC-23416

### IDENTIFICATION OF THE PHOTOCHEMICALLY ACTIVE SPECIES IN SULFUR DIOXIDE PHOTOLYSIS WITHIN THE FIRST ALLOWED ABSORPTION BAND.

Preprint, Ohio State Univ., Columbus, Dept. of Chemistry, 10p., 1969. 9 refs.
Sachiko Okuda, T. Navaneeth Rao, David H. Slater, and Jack G. Calvert.
Identifiers: *Sulfur dioxide, *Photochemical reactions, *Reaction kinetics, Quenching, Sulfur oxides, Sulfur trioxide, Photolysis, Reaction mechanisms.

Experiments were conducted to determine the rates of photochemical formation of sulfur trioxide at 3167-2537 A in a flow system using pure sulfur dioxide (737 and 740 mm) - biacetyl (3.3 mm) mixtures at 25 C. The results are summarized in a logarithm of the SO3 photochemical product vs. time. A marked lowering of the rate of SO3 formation in runs with added biacetyl is indicated. This lowering is not an artifact associated with the presence and reaction of carbonyl compounds with sulfur oxides, since within experimental error the rate of SO3 formation was not affected when acetone (9.5 mm) was added to the SO2 (730 mm). The result is in good agreement with that expected if excited triplet state sulfur dioxide is the only reactive precursor to SO3 formation. Together with estimated quantum yields of SO2 formation, the photochemical rate data establish that excited triplet state sulfur dioxide molecule is the dominant chemically active species leading to sulfur trioxide in sulfur dioxide photolysis within the first allowed absorption band. It is further suggested that practically all of the triplets formed in the photolysis of pure sulfur dioxide at high pressures react to give sulfur trioxide product.
APTIC-23418

### INVESTIGATION OF THE PENETRATION OF AN AIR JET DIRECTED PERPENDICULARLY TO AN AIR STREAM.

National Advisory Committee for Aeronautics, Cleveland, Ohio, Flight Propulsion Research Lab., TN-1615, 13p., June 1948.
Edmund E. Callaghan, and Robert S. Ruggeri.
Identifiers: *Aerodynamics, *Air jet, *Penetration coefficient, Mathematical analyses, Flow rates, Density.

An experimental investigation was conducted to determine the penetration of a circular air jet directed perpendicularly to an air stream as a function of jet density, jet velocity, air-stream density, air-stream velocity, jet diameter, and distance downstream from the jet. The penetration was determined for nearly constant values of air-stream density at two tunnel velocities, four jet diameters, four positions downstream of the jet, and for a large range of jet velocities and densities. An equation for the penetration was obtained in terms of the jet diameter, the distance downstream from the jet, and the ratios of jet and air-stream velocities and densities. The variation of penetration coefficient with jet Reynolds number, width coefficient, and viscosity ratio was negligible for a range of jet Reynolds numbers from 60,000 to 500,000, a range of width coefficients from 3.2 to 8.0, and a range of viscosity ratios from 1.5 to 1.9. (Author summary modified)
APTIC-23434

### SOLID STATE REVERSIBLE REACTIONS OF SQUARE PLANAR D TO THE 8TH POWER COMPLEXES WITH SULFUR DIOXIDE.

J. Organometal. Chem., vol. 21:P23-P27, 1970. 8 refs.
Eneo C. Moroni, R. A. Friedel, and Irving Wender.
Identifiers: *Adsorption, *Sulfur dioxide, Retention, Stack gases, Metal compounds, Chemical reactions, Solids.

Reactions of sulfur dioxide and crystals of square metal planar complexes were reversible, exothermic, and markedly affected by the temperature and partial pressure of SO2. The SO2 uptake decreased and the rate of SO2 sorption increased with increasing temperature. No significant effect of crystal size on yield, rate, or exothermicity of SO2 sorption was observed, an indication that very little SO2 is physically adsorbed. Total desorption of SO2 by heating was possible only with RhCl (CO) (PPh3)2; an inert gas or pumping was needed, in addition to heating, to remove practically all the SO2 from the other complexes studied. A more accurate account of desorption of SO2 from the adduct IrCl (CO) (PPh3)2 (1.8SO2) was determined by monitoring the reaction by mass spectrometry. Crystals of trans-IrCl (CO) (PPh3)2 (I) rapidly picked up more than one mole of SO2 per mole. Molecular oxygen also forms a 1/1 adduct with I in benzene solution but does not react with crystals of I. Since both O2 and SO2 are present in flue gases, the selective sorption of SO2 by the crystals of I is viewed as an additional benefit provided by the solid-state reaction.
APTIC-23471

### GENERATOR FOR PRODUCING HIGH CONCENTRATIONS OF SMALL IONS.

Rev. Sci. Instr., 32 (12):1351-1355, 1961. 1 ref.
K. T. Whitby.
Identifiers: *Aerosol generators, *Design criteria, *Ions, Aerosols, Ionization, Corona.

An arrangement of a needle and a sonic orifice is described which is capable of converting the corona current into free small ions with 100% efficiency is described. Positive and negative ion concentrations of 10 to the 11th power ions cu/cm in the sonic jet and total ion outputs of 10 to the 14th power sec were achieved using 2.5 cfm of free air at 30 psig through a 1/16 in. orifice. Theoretical and experimental studies of the ion decay rate in the jet show that the concentrations drop off approximately as the square of the distance from the ionizer. The original application of the ion generator was for the neutralization of electrically charged homogeneous aerosol particles generated by the evaporation of dilute solutions of dye. Effective neutralization is obtained when positive and negative ions are mixed with the aerosol a few centimeters from the ionizer and then held in a chamber for a few seconds. As an example of the effectiveness of this arrangement, the charge on an aerosol of 2.3 -micron particles having a median positive charge of 630 electrons per particle was reduced to 5 electrons per particle. The simplicity, low cost, and high output of this ion generator also makes it useful for studies of the behavior of ions in occupied areas. (Author abstract modified)
APTIC-23495

### A METHOD FOR THE PREPARATION OF INSOLUBLE SULFUR.

(Verfahren zur Herstellung von unloeslichem Schwefel). Text in German. (Kali-Chemie A. G., Hannover (West Germany)) West Ger. Pat. 1,036,831. 2p., Aug. 21, 1958. (Appl. June 16, 1954, 1 claim).
Peter Wolfgang Schenk.
Identifiers: *Sulfur oxides, *Hydrogen sulfide, *Reduction, *By-product recovery, Plastics, Germany, Hydrochloric acid, Sodium chloride.

Plastic, fast hardening sulfur is produced by saturating 15% sodium chloride and approximately 4% hydrogen chloride solution at room temperature with sulfur dioxide and precipitating sulfur by the introduction of hydrogen sulfide. The method is an improvement over other methods in that it reduces the hardening time of the sulfur from 8 to 14 days to 3 days, it yields 82% insoluble sulfur, the product does not smell of H2S, and it can be easily ground. The precipitating sulfur is easily filtered and does not smell of H2S if the precipitating solution is saturated with excess SO2.
APTIC-23523

### CHEMICAL APPLICATIONS OF METASTABLE ARGON ATOMS. III. THE PRODUCTION OF KRYPTON AND XENON METASTABLE ATOMS.

Preprint, Kansas State Univ., Manhattan, Dept. of Chemistry, 28p., 1970 (?). 38 refs.
D. H. Stedman, and D. W. Setser.
Identifiers: *Krypton, *Xenon, *Argon, *Chemical reactions, Spectrometry, Nitrogen, Carbon monoxide, Nitrous oxide (n2o).

An inexpensive experimental technique is described for the production of argon, krypton, and xenon metastable atoms using a low power discharge-flow system. Expense is reduced by using mostly argon diluent; a hollow cathode system is employed in which a stream of purified tank argon is passed through a 6-mm i.d. hollow tantalum cathode, past two light traps, and into the mixing zone where reagent is added. The reactions of these metastable atoms with nitrogen, carbon monoxide, and nitrous oxide were investigated in the pressure range of 0.3 to 10 torr, and the emission spectra taken from 2000-11000 A resulting from the reactions were identified. These spectra give information about the collision event and also about some of the relaxation processes. For xenon and krypton, the lower metastable state is mainly present, but both metastables are present in argon. Franck-Condon factors apparently do not control the molecular excitation processes in collisions of excited heavy atoms with light diatomic molecules. The sources described here for the metastable atoms could provide sufficient intensity for high resolution studies of some of the emission bands of CO and N2O which are not well understood at the present time. (Author abstract modified)
APTIC-23534

### CATALYTIC HYDROGENATION OF SULFUR DIOXIDE.

(Hydrogenation catalytique de l'anhydride sulfureux). Text in French. Compt. Rend., vol. 176:35-36, Jan. 3, 1923. 2 refs.
Margaret G. Tomkinson.
Identifiers: *Sulfur dioxide, *Catalysis, *Hydrogenation, France, Hydrogen, Nickel compounds, Hydrogen sulfide, Flow rates, Water, Temperature.

A mixture of dry sulfur dioxide and hydrogen was passed through a column filled with a nickel catalyst prepared by calcination of nickel oxalate in H2 at 280 C. No reaction was observed between 200 and 280 C; above 280 C, some water vapor was formed. At about 350 C, hydrogen sulfide and H20 were formed, while between 400 and 450 C, H2S, H20 and sulfur were formed simultaneously. When the rate of flow of the SO2-H2 mixture was low, all of SO2 was transformed. At the end of these experiments, which could be continued indefinitely, with the same results the catalyst consisted entirely of NiS. It was verified that no reaction took place in the absence of the Ni catalyst at temperature between 200 and 500 C and the Ni catalyst had no effect on H2S alone at these temperatures. These findings suggested that the above reaction is catalyzed by NiS rather than by Ni. This conjecture was verified in experiments using NiS prepared by precipitating and alkaline solution of nickel acetate by H2S and by calcinating the precipitate with sulfur in a current of H2, or by direct sulfurization of NiO in a current of H2S at 200 C. Both varieties of NiS catalyze the hydrogenation of SO2 at temperatures above 800 C without being affected by the reaction. The catalytic effect of NiS on hydrogenation does not extend to the changes of propanone into isopropylic alcohol attempted between 100 and 260 C, nor to the change of CO2 into methane at 300 C. CoS2 and FeS2 act like NiS, while Cu and CdS are totally inactive.
APTIC-23543

### ABSORPTION COEFFICIENTS OF OZONE IN THE HARTLEY BAND.

Coefficients d'absorption de l'ozone dans la bande de Hartley). Text in French. Centre National de la Recherche Scientifique, Paris (France), Proc. Symp. Ozone Atmospherique, Monaco, 1968, p. 85-88. 5 refs. (Sept. 2-7.) CFSTI: N70-16615
E. Vigroux.
Identifiers: *Spectrophotometry, *Ozone, France, Absorption, Ultraviolet spectrometry.

The most recent measurements of absorption coefficients of ozone in the laboratory in ultraviolet agree well up to 2700 A, but for shorter wavelengths results reported here are slightly lower than those of other investigators. Previous methods differ from those reported particularly in the process of absolute measurement of the ozone which involves chemical dosages of ozonized oxygen. Previous investigations made use of purely physical processes based on the variation of pressure at constant volume produced by the decomposition of initially pure ozone. Equipment used includes photographic spectrophotometer, the Hilger Medium spectrograph, and 2 hydrogen tubes. In the 1952 results there was agreement between two measurement series, with the passage of one series to the other corresponding to the variation of the shorter tube, at a wavelength of 2702 A. A coefficient of absorption was found for all wavelengths below 2702 A, thus, in all measurements made with the shorter tube. An absorption coefficient was not found for 2536.5 A; it is between 132 and 133 with an error of plus or minus 1.7, thus approximately equal to the value found by Hearn to be 133.9 plus or minus 1.9.
APTIC-23552

### THE GASEOUS REACTION BETWEEN HYDROGEN SULPHIDE AND SULPHUR DIOXIDE.

J. Phys. Chem., vol. 31:216-230, 1927. 24 refs.
H. Austin Taylor, and W. Andrew Wesley.

Identifiers: *Sulfur dioxide, *Hydrogen sulfide, *Adsorption, *Catalytic oxidation, Glass, Catalytic activity, Combustion, Gases, Reaction kinetics, Reaction mechanisms, Pressure, Temperature.

Measurements were made of the velocity of combustion of hydrogen sulfide and sulfur dioxide in Pyrex reaction tubes at 370-730 C. The velocity was proportional to the surface area of the reaction chamber, which proves that the glass surface acts as a contact catalyst for reaction. The temperature coefficient decreased with increasing temperature. At constant temperature, the velocity varied directly as the partial pressure of sulfur dioxide and that of hydrogen sulfide increased to the 1.5 power. A reaction mechanism is suggested that is in agreement with modern theories of heterogeneous reactions. According to the mechanism, each of the reactants is activated by adsorption on the surface of the glass and reaction then follows between the activated molecules only. (Author summary modified)
APTIC-23574

### TURBULENT PIPE FLOW OF MAGNESIA PARTICLES IN AIR.

Ind. Eng. Chem. Fundamentals, 5 (3):388-392,
1966. 10 refs.
S. L. Soo, and G. J. Trezek.
Identifiers: *Magnesium compounds, *Flow rates, *Particulates, Mathematical analyses, Oxides, Solids, Density, Electric charge.

Results of experiments on concentration and mass flow distributions in turbulent gas-solid pipe flow are presented to make possible determination of various parameters of the solid phase over wide ranges of loading and flow velocities. Apparatus included the 5-in. pipe flow system, electrostatic probe for mass flow distribution, fiber optical probe for concentration distribution, and sampling tape measure of collision rate at the wall. The fluid used was nominal 30-micron magnesium oxide particles in air. Experimental range included mass ratios up to 3 lbs of solids per pound of air at Reynolds numbers from 1.3 times 100,000 to 2.95 times 100,000. The density distribution of solid particles is strongly influenced by their average charge to mass ratio, while the velocity distribution of the particles remains in the range where the collision among the solid particles is negligible.
APTIC-23577

### INSERTION OF SULPHUR TRIOXIDE INTO THE METAL-CARBON BOND OF DIMETHYLMERCURY.

Chem. Commun., vol. 19:1259, 1970. 5 refs.
K. A. R. Salib, and J. B. Senior.
Identifiers: *Mercury compounds, *Sulfur trioxide, *Chemical reactions, Canada, Spectrometry, Esters, Organic sulfur compounds, Chemical bonds.

The exothermic reaction between dimethylmercury and sulfur trioxide in methylene chloride solution at -70 deg gives methylmercuric methanesulfonate, and upon further addition of sulfur trioxide, a soluble product in which one mercury-carbon bond remains intact. A downfield shift in the methyl proton resonance upon formation of the product suggests that it is methylmercuric methanedisulfonate. Identification of the precipitate and product was accomplished by infra red and nuclear magnetic resonance spectrometry and X-ray powder diffraction. (Author summary modified)
APTIC-23592

### THERMAL AND RECOMBINATION EMISSION OF NO2.

J. Chem. Phys., 53 (2):647-658, July 15, 1970. 32
refs.
D. E. Paulsen, W. F. Sheridan, and R. E. Huffman.
Identifiers: *Recombination, *Emissivity, *Thermal radiation, *Nitrogen dioxide (no2), Spectrometry, Visible radiation, Thermodynamics, Temperature.

The visible emission from electronically excited nitrogen dioxide was studied both with thermal excitation in an electric oven and with recombination excitation from the nitric oxide-atomic oxygen reaction. In both cases, the emission is continuous with superimposed weak, diffuse bands. The correlation of these bands with NO2 absorption bands has been extended. The thermal emission continuum begins near 3300 A and increases in intensity to 8000 A. The recombination emission continuum begins near 3800 A and has a broad maximum at 6200 A, in general agreement with previous workers. The absolute intensity of the thermal emission was obtained at 100-A intervals between 4600 and 8000 A for temperatures between 972 and 1335 K. Excitation energies, which were obtained from the variations of intensity with temperature, ranged from 77 kcal at 4000 A to a minimum of 44 plus or minus 1 kcal near 8300 A. The latter value is the minimum energy of the emitting state of NO2. Radiative lifetimes obtained for thermal emissions ranged from 100 to 1 microseconds, depending on emission wavelength, and are in approximate agreement with fluorescent lifetimes for comparable excitation energies. Because chemical equilibrium was obtained in the experiments, the present data should be more suitable than data obtained in shock tube experiments for calculating the intensity of NO2 emissions at high temperatures. However, meaningful absorption coefficients cannot be calculated from the new emission data since the results show that absorption and emission processes are not identical. (Author abstract modified)
APTIC-23601

### CALCULATION OF THE TURBULENT DISPERSION OF FREE JETS.

(Ueber die Berechnung der turbulenten
Ausbreitung von Freistrahlen). In: Probleme des
thermischen Bodeneffekts Bericht ueber die
Sitzung der DFVLR- Arbeitsgruppe
Strahlfuehrung am 27./28.2. 1969 in Braunschweig.
Text in German. Deutsche Forschungs- und
Versuchsanstalt fuer Luft- und Raumfahrt
Braunschweig (West Germany), Inst. fuer
Strahlantriebe, Deutsche Luft- und Raumfahrt
Rept. 69-14, p. 60-69, June 1969. CFSTI: N70-
16108
Edgar Juenke.
Identifiers: *Dispersion, *Mathematical modeling, *Jets, Germany, Flow rates.

The general properties of free jets are discussed, including reasons for the nonuniversality of two model constants, which must always be determined experimentally and which used in an equation that expresses the ratio of maximum velocity to the velocity of that of the nozzle as a function of nozzle diameter. The treatment of initial and boundary conditions in theories concerning the dispersion of the turbulent free jet are discussed.
APTIC-23622

### EFFECT OF ELECTRIFICATION ON THE DYNAMICS OF A PARTICULATE SYSTEM.

Ind. Eng. Chem. Fundamentals, 3 (1):75-80, Feb.
1964. 19 refs.
S. L. Soo.
Identifiers: *Particulates, *Mathematical analyses, *Flow rates, *Electric charge, Solids.

The significance of electrification on the dynamics of a gas-solid system is theoretically analyzed with some reference to studies in the literature. The dynamics of a system of charged solid particles are considered, as well as simple symmetric systems and turbulent flow of charged gas-solid suspensions through a pipe. At low temperatures, electrification of solid particles occurs because of impact with a wall. Basic considerations include motion of charged particles with spherical symmetry and axi-symmetry. The pinch effect due to motion of particles charged to the same sign is insignificant. However, even a very slight charge on the solid particles will have a pronounced effect on concentration distribution in the flow of a gas-solid system. (Author abstract modified)
APTIC-23636

### REMOVAL OF HYDROGEN CYANIDE FROM AIR WITH ALKALI SOLUTIONS.

(Ob Ochistke Vozdukha ot Sinil'noy Kisloty
Rastvorami Shchelochi). Text in Russian. Khim.
Prom. (Moscow), no. 1:36-37, 1967.
V. V. Zhitineva, V. I. Sidorov, G. K.
Mitryushkina, and G. N. Fedorina.
Identifiers: *Absorption, *Cyanides, Ussr, Hydrocyanic acid, Sodium carbonate, Sodium hydroxide, Temperature.

Laboratory studies of the effect of temperature (30-70 C) and absorbent composition (NaOH and Na2CO3) on HCN removal from air are reported. Failure to provide adequate removal by this method led to the discovery that hydrogen cyanide is reformed in the filter through hydrolysis of sodium cyanide. Passing the filtered air through a small amount of pure, low-concentration (0.85-3.5 g/l) alkali gave complete hydrogen cyanide removal.
APTIC-23637

### SPECTROANALYSIS OF THE RADIATION EMITTED DURING THE DECOMPOSITION OF OZONE.

Z. Wiss Photor., Photophysik, Photochem., 19 (7,
8):1-39, 1920. 104 refs. Translated from German.
39p.
Karl Stuchtey.
Identifiers: *Spectrophotometry, *Ozone, *Fluorescence, Germany, Nitrogen, Oxygen, Decomposition, Oxidation, Ultraviolet radiation, Visible radiation.

A spectrographic analysis of the luminescence observed during the decomposition of ozone is described. By heating ozone to about 400 C in a special furnace, a strong luminescence is induced. The emission spectrum is in the visible and ultraviolet regions, which coincides with known ozone data. Measurements of an ozonized mixture of oxygen and nitrogen are also studied. The mechanism of the observed luminescence is explained, and the concepts of processes occurring during ozone formation in glow discharge are verified. The nature of ozone luminescence is independent of the substances which are oxidized. Special spectrographic techniques and equipment are developed for the purposes of this investigation.
APTIC-23638

### MODE OF FORMATION OF 3,4-BENZOPYRENE IN HUMAN ENVIRONMENT.

For primary bibliographic entry see Field 07.
APTIC-23667

### KINETICS OF THE THERMAL DECOMPOSITION OF LITHIUM NITRATE.

Princeton Univ., N. J., Plasma Physics Lab.,
Contract AT (30-1)-1238, 140p., Dec. 1964. 39 refs.
CFSTI: MATT-324
S. H. Cho, and E. F. Johnson.
Identifiers: *Lithium compounds, *Nitrates, *Decomposition, *Reaction kinetics, Reactors (nuclear), Thermodynamics, Pressure, Temperature.

Lithium salts have been considered as possible candidates for the coolant and tritium breeder in the blanket system of a controlled thermonuclear reactor. The thermal decomposition of lithium nitrate in the blanket system would play an important role in the engineering features of such a system, in which the solid lithium oxide and gases such as nitric oxide and nitrogen dioxide formed during the course of the decomposition process would have to be handled. Due to the complexity of the chemical reactions in the thermal decomposition of the nitrates of the alkali metals, very few quantitative studies dealing with this problem are available. Detailed data is presented on the kinetics of the thermal decompositon of lithium nitrate in the temperature range 450 to 500 C, using various amounts of the inert gas, argon, to study the effect of pressure on the system. Various hypothetical kinetic models are investigated to

determine the model which best fits the experimental data by a least squares criterion. The specific rate constants and thermodynamic properties are computed for the model, and an estimate is made of the errors involved in the method. (Author abstract modified)
APTIC-23686

### NATURE OF AIR IONS GENERATED BY DIFFERENT METHODS.

American Inst. of Medical Climatology,
Philadelphia, Pa., Proc. Intern. Conf. Ionization
Air, Philadelphia, Pa., 1961, 1 (2):13p. 8 refs.
Rudolph Nagy.
Identifiers: *Electrostatic aerosol generators, *Ions, Inhalation therapy, Heat transfer, Ultraviolet radiation, Radioactive radiation, Corona, Electric charge.

An analysis of the various methods of ion generation was undertaken to better understand the mechanism of ion formation and to see whether an explanation for the differences in the physiological results could be obtained. The methods examined were charge separation, thermionic emission, corona discharge, radioactive materials, and ultraviolet radiation. Separation of the electron in the first method is governed by complex forces similar to the contact potentials of metals. The sign of the charge on the particle would depend upon the type of dust, duct material, and traces of adsorbed gases or impurities on the particles. Many of the common impurities in air would result in the formation of positive ions when blown through iron or aluminum ducts. A problem with corona discharge is that, due to the multiple charges they have acquired, large particles may be recorded as much smaller ions having higher mobility. If a low thermionic work function material such as barium oxide were placed on a hot wire, a large number of ions would be obtained. However, positive ions are also generated with hot wires, probably as a result of impurities in the air striking the hot filament. A single alpha particle from polonium-210 can produce about 150,000 ion pairs, but in the absence of a voltage gradient there is a very rapid recombination of the ions producing neutral atoms. Quartz ultraviolet lamps have been reported to ionize the air, but even the shortest radiation from such lamps does not have sufficient energy to ionize oxygen or nitrogen.
APTIC-23693

### INTERACTION OF AEROSOLS AND AIR IONS.

American Inst. of Medical Climatology,
Philadelphia, Pa., Proc. Intern. Conf. Ionization
Air, Philadelphia, Pa., 1961, 15p. 8 refs.
K. E. Schaefer, and J. H. Dougherty.
Identifiers: *Aerosols, *Ions, Particle size, Aerosol generators, Spacecraft atmospheres, Condensation, Nucleation.

In an effort to standardize the experimental conditions in research on physiological effects of ions, measurements were made of ions of various mobilities which passed from a mixing chamber into a respiratory mask. Under conditions of prolonged confinement in the closed space of a submarine or a space capsule, microclimatic factors such as aerosols and ions might become important. One hundred thousand small ions per ml were produced by a Philco ion generator placed inside a mixing chamber. Small ions decreased continuously with increasing condensation nuclei while the levels of medium and large ions showed an increase until the condensation nuclei reached about the same concentration as the ions. Maximal ion concentrations were generated with the Philco corona discharge instrument and 1.2-1.4 million per ml were obtained in the range of smaller ions; an attempt was made to measure additional slower mobilities corresponding to larger ions. The number of ions having a mobility of .3-.06 and .07-.007 lm/s/V/cm was significantly less than those of the smaller ions and ranged from 40,000 to 250,000 per ml. In another experiment, the ion concentrations were significantly smaller in the respiratory mask than in the mixing chamber. However, the relationship was fairly linear for small ions from high concentrations on down to a level of approximately 20,000 ions. A similar relationship was observed for medium size and larger ions down to concentrations of approximately 50,000 ions.
APTIC-23694

### FLUID FLOW PHENOMENA IN DUSTY AIR.

Preprint, American Society of Mechanical
Engineers, New York, 11p., 1969. 15 refs.
(Presented at the American Society of Mechanical
Engineers, Winter Annual Meeting, Los Angeles,
Calif., Nov. 16-20, 1969, Paper 69-WA/FE-24.)
CFSTI, DDC: AD704665
M. P. Boyce, and E. F. Blick.
Identifiers: *Dusts, *Fluid flow, Particle size, Mathematical analyses, Gases, Solids, Pressure, Surface properties.

The effect of adding dust to clean air flowing in a turbulent motion is the reduction of skin-friction coefficient of the surface in contact with it; particle size, weight-flow ratio, and the Reynolds number are the most important parameters in this type of flow. Research previously done in the gas-solid flow area is indicated tabularly. Extensive experimental data were obtained on the pressure gradients encountered in circular pipes when a mixture of gas and solid particles flowed through the pipe, and skin-friction drag was measured on a flat plate placed flush in the floor of a wind tunnel. Both experiments were conducted over a moderate range of Reynold numbers, from close to the laminar flow region to the fully developed turbulent flow region. Particle sizes were varied from silica dust (2 to 60 microns) to glass beads (1680 microns). Another parameter which was also greatly varied was the ratio of solid to gas mass-flow rates. Viscosity was decreased by the addition of dust where the smaller particles were concerned, but there was an increase in viscosity for the larger particles. A theory is presented attempting to explain some of the complex flow phenomena encountered in a two-phase flow system.
APTIC-23721

### MIE SCATTERING CALCULATIONS OF THE CONTRIBUTION OF ATMOSPHERIC AEROSOLS TO THE MARTIAN OPPOSITION EFFECT.

Preprint, National Aeronautics and Space
Administration, Greenbelt, Md., Theoretical
Studies Branch, 75p., June 1970. 39 refs. CFSTI:
N70-28672
Jaylee Montague Mead.
Identifiers: *Mie scattering, *Aerosols, *Light radiation, *Refractive index, Particle size, Mathematical analyses, Mathematical modeling, Scattering (atmospheric), Carbon dioxide, Infrared radiation, Ultraviolet radiation, Light scattering, Water, Ice.

The Mie theory is used to compute the integrated scattering intensities for spherical submicron aerosol particles with various indices of refraction and several size distributions in an effort to determine if the presence of atmospheric aerosols can account for the Martian opposition effect, as observed by O'Leary and by Koval' in 1967. This nonlinear surge in brightness, as the planet approaches a phase angle of 0 deg, is reported to be much more pronounced in the ultraviolet than in the infrared. The calculations show that neither substances having a refractive index n between 1.20 and 1.50 (including ice, water, and solid carbon dioxide) nor highly absorbing materials, such as limonite, can produce the opposition effect. On the other hand, aerosols having more than 1.50 with little or no absorption, such as meteoric particles or suspended surface dust composed of semitransparent minerals, do exhibit a definite increase in reflectivity at small phase angles. By introducing an assumed surface function, which is added to the contribution by a layer of submicron-size aerosols with n equals 1.65, a model is obtained which compares reasonably well with the observations. The range for which fits could be obtained would make most semitransparent minerals good candidates for producing the opposition effect. The results demonstrate that the presence of a small amount of atmospheric aerosols, with the proper index of refraction, could provide the observed increased opposition effect for Mars in the ultraviolet, where the albedo is very low and a small brightness contribution by aerosols will have a comparatively large effect, but at the same time make a negligible contribution in the infrared, where the surface albedo is high. (Author abstract modified)
APTIC-23752

### OXIDANT FORMING CHARACTERISTICS OF ORGANIC SOLVENTS.

Air Pollution Control Assoc., Los Angeles, West
Coast Section, Proc. Air Pollution Control Assoc.,
West Coast Sect., 1st Tech. Meet., Los Angeles,
Calif., 1957, p. 6-12. 8 refs. (March 25-26.)
Margaret Fox.
Identifiers: *Hydrocarbons, *Ozone, *Photooxidation, Acids, Acetic acid, Formic acid, Alcohols, Aldehydes, Esters, Chlorinated hydrocarbons, Olefins, Butadienes, Aromatic hydrocarbons, Nitrogen dioxide (no2).

The role of solvent mixtures in photochemical processes was studied by determining the ozone-forming potential of their components. No ozone formation was observed with straight-chain saturated hydrocarbons of less than 4 carbon atoms. As the length of the chain increased from 4-8, the activity gradually increased. With the 1-n-olefins, maximum activity was 5 mm. Alcohols from C1-C5 appeared to have the same activity as the active 1-n-olefins, since they developed a crack depth of 5-6 mm. Aldehydes from C1-C4 were constant in their activity, with a value of 4 mm total crack depth. Substitution of some methyl groups in the benzene ring of the aromatic series resulted in an ozone-forming potential comparable to that of the alcohols. Formic and acetic acids gave no ozone formation, but propionic and butyric acids gave 4 and 6 mm, respectively. Butadiene, the most active compound tested, gave 12 mm in the presence of nitrogen dioxide and butyl nitrate gave 12 mm by irradiation alone. Chlorinated hydrocarbons had a low order of activity. The esters tested had an activity of about 3 mm.
APTIC-23759

### THERMODYNAMIC PROPERTIES OF ZINC SULFATE, ZINC BASIC SULFATE, AND THE SYSTEM ZN-S-O.

Trans. AIME (Am. Inst. Mining, Metallurgical,
and Petroleum Engr.), vol. 227:1419-1426, Dec.
1963. 19 refs.
T. R. Ingraham, and H. H. Kellogg.
Identifiers: *Zinc compounds, *Sulfates, *Thermodynamics, Primary metallurgical processing, Oxides, Decomposition, Physical states, Crystal structure, Pressure, Temperature.

The total gas pressure developed from decomposition of either zinc sulfate or zinc oxide-2ZnSO4 in a closed system was measured. A flexible Pyrex bellows was used to separate the reaction gas mixture (SO3, SO2, and O2) from the mercury in the manometer, and thus prevent corrosion of the mercury by SO3. In addition to the decomposition-pressure measurements a number of auxiliary experiments involving differential thermal analysis, thermogravimetric analysis, and x-ray diffraction were made. Three anhydrous zinc sulfates have been identified: ZnSO4 (alpha), stable below 1007 K; ZnSO4 (beta), stable above 1007 K; and ZnO-2ZnSO4. DTA measurements on ZnSO4 consistently show a sharp and reversible endothermic peak at about 1007 K, indicative of crystal transformation. Availability of reliable high temperature equilibrium data for the various zinc sulfates makes possible the construction of the thermodynamic phase diagrams for the ternary system, showing the stable univariant and bivari-

ant equilibrium relations. In the temperature interval 90011300 K, only one true invariant point is found: that resulting from the crystal transformation in $ZnSO_4$ at 1007 K. The other apparent invariant point at 1181 K results from the arbitrary selection of 1 atm pressure to divide the fields of stability of liquid and gaseous zinc. Another peculiarity of the Zn-S-O system is that the univariant equilibria exhibit $SO_2$ pressures which are either too high or too low for direct measurement. Application of these diagrams to problems of roasting zinc concentrates is discussed.
APTIC-23798

### THE AERODYNAMIC DIAMETER OF LATEX AGGREGATIONS AND ASBESTOS FIBERS.

(Der aerodynamische Durchmesser von Latexaggregaten und Asbestfasern). Text in German. Staub, Reinhaltung Luft, 30 (7):277-285, July 1970. 18 refs.
Werner Stoeber, Hermann Flachsbart, and Dieter Hochrainer.
Identifiers: *Particle size, *Aerodynamics, Deposition, Asbestos, Synthetic rubber, Germany, Settling particles, Particle shape.

A study of the aerodynamic diameter of clusters and chain aggregates of monodisperse latex spheres of submicron size and of asbestos fibers is presented. The results for cluster aggregates can easily be interpreted theoretically. The aerodynamic diameters of chain aggregates can be represented by an analytical expression involving the sphericity of the particles. The aerodynamic diameter is only slightly influenced by the chain length but is predominantly proportional to the diameter of the primary spheres. Similar results are obtained from experiments with asbestos fibers. The results are discussed with regard to deposition properties in the size range of submicron aerodynamic diameters. (Author abstract modified)
APTIC-23804

### ELECTRIFICATION ASSOCIATED WITH BREAKUP OF DROPS AT TERMINAL VELOCITY IN AIR.

J. Atmos. Sci., 27 (6):927-936, Sept. 1970. 21 refs.
J. V. Iribarne, and M. Klemes.
Identifiers: *Droplets, *Ions, *Electric charge, Canada, Flow rates, Surface properties.

The electrification accompanying the breakup of large drops falling in air in the absence of an electric field is studied. A closed circuit vertical tunnel is used, and the chemical composition of the drops is carefully controlled. The results obtained for the average charge separation between the large and small fragments are non-specific regarding the nature of the ions present (except for surface-active species), but strongly dependent on the electrolytic conductivity. The magnitude of the effect for pure water and for concentrated solutions is given. These results can be interpreted on the basis of two competing processes, one of which is the shearing of the electrical double layer on the water-air interface while the air develops the characteristic liquid film bag or bubble. (Author abstract modified)
APTIC-23806

### AEROSOL PRODUCTION BY H2S- PHOTOLYSIS.

In: Aerosol Research at the First Physics Institute of the University of Vienna. Vienna Univ. (Austria), p. 132-161, May 1970. 7 refs.
Friedrich Scholz.
Identifiers: *Aerosols, *Hydrogen sulfide, *Photolysis, Europe, Particle size, Spectrometry, Ultraviolet radiation, Nucleation, Visible radiation, Supersaturation.

Certain gases and gaseous mixtures yield nuclei when illuminated with ultraviolet or visible light. The production of nuclei by photochemical decomposition of hydrogen sulfide is investigated. Fundamental photochemical laws are discussed, and the photochemical decomposition of $H_2S$ is described. The experimental method involves diluting the $H_2S$ with nitrogen, exposing it to weak UV-irradiation, thereby causing supersaturation and the production of nuclei. An aerosol spectrometer is used to determine the size distribution of the aerosols produced. The production of sulfur aerosols by the addition of primary particles in the reaction mixture is also studied.
APTIC-23871

### MASS TRANSFER CHARACTERISTICS OF WOVEN-WIRE SCREEN CATALYSTS.

Preprint, Massachusetts Inst. of Tech., Cambridge, Dept. of Chemical Engineering, 38p., 1969 (*). 19 refs.
Charles N. Satterfield, and Douglas H. Cortez.
Identifiers: *Catalytic oxidation, *Hexenes, *Catalysts, Platinum, Chemical processing, Excess air, Transport, Nitric acid, Ammonia, Toluenes, Flow rates, Heat transfer, Reaction kinetics, Reaction mechanisms.

Gauze catalysts woven from a fine platinum-rhodium wire have long been used in the partial oxidation of ammonia for the industrial manufacture of nitric acid. An investigation of the possibility that the catalytic oxidation of hydrocarbons in air might under some circumstances proceed by initiation of reaction on a catalyst surface followed by propagation of the reaction into the surrounding gas, or so-called hetero-homogeneous catalysis, is described. The rate of oxidation of hexene or toluene in excess air on platinum screen catalysts under mass transfer controlled conditions is used to calculate 'j' factors. Previous literature data on heat and mass transfer are re-examined and re-correlated and the transport characteristics of screen catalysts are shown to be very similar to that of infinite cylinders. There is no positive evidence that any of the hydrocarbon oxidation in these studies or that of the oxidation of ammonia on platinum gauze under industrial conditions occurs as a homogeneous process. (Author abstract modified)
APTIC-23882

### PYROLYSES IN THE PRESENCE OF NITRIC OXIDE. PART II. N-BUTANE.

J. Chem. Soc., vol. 13:2333-2336, 1970. 7 refs.
G. B. M. Eastmond, and G. L. Pratt.
Identifiers: *Ethane, *Nitric oxide (no), *Pyrolysis, Great britain, Aliphatic hydrocarbons, Butanes, Methanes, Hydrogen, Nitrogen, Free radicals, Reaction kinetics, Reaction mechanisms.

The ethyl radical is an important chain-carrying species in both the pyrolysis of ehtane and that of n-butane. The mechanism proposed for the pyrolysis of ethane in the presence of nitric oxide therefore has a direct bearing on the mechanism of pyrolysis of the larger paraffin. The formation of hydrogen, methane, and nitrogen during the very early stages of the pyrolysis of n-butane (15-250 Torr) with nitric oxide (0-200 Torr) at temperatures of 435-508 C is studied. A mechanism based on that proposed for the pyrolysis of ethane with nitric oxide accounts for the observed kinetics. Values for the rate constant of a reaction involving nitric oxide at 455 and 472 C are deduced. (Author abstract modified)
APTIC-23891

### ELECTRON SPIN RESONANCE SPECTRA OF RADICALS FORMED FROM NITROGEN DIOXIDE AND OLEFINS.

J. Phys. Chem., 74 (21):3834-3835, 1970. 7 refs.
M. C. R. Symons.
Identifiers: *Electron spin resonance spectra, *Olefins, *Nitrogen dioxide (no2), Great britain, Spectrometry.

The choice of the charge-transfer complex theory to interpret results for solutions of nitrogen dioxide in various unsaturated solvents as previously reported is criticized. Using evidence obtained from experiments involving the comparison of liquid- and solid-state electron spin resonance spectra with those of authentic nitroxides, the author submits that the disputed spectra are almost certainly caused by the formation of nitroxide radicals. Several of the compounds in question were reexamined, and the solid state spectra obtained were all typical of nitroxides.
APTIC-23909

### MO SCF STUDIES ON THE PROTONATION OF CARBON MONOXIDE AND THE NITROGEN MOLECULE USING GAUSSIAN BASIS SETS.

Chem. Phys. Letters (Amsterdam), 6 (3):128-132, Aug. 1, 1970. 24 refs.
S. Forsen, and B. Roos.
Identifiers: *Protonation, *Nitrogen, *Carbon monoxide, Sweden, Computers, Ions, Thermodynamics, Electrical properties, Electric charge.

Ab initio MO SCF calculations based on Gaussian type functions were performed to study the protonation of carbon monoxide in the reaction H (+) + CO yields HCO (+) and of the nitrogen molecule in the reaction H (+) + $N_2$ yields $N_2H$ (+). The geometry of the protonated species was investigated in some detail. The calculated proton affinities are 118 kcal/mole for $N_2$ and 137 kcal/mole for CO, for the most stable ion HCO (+). (Author abstract modified)
APTIC-23915

### THEORETICAL CALCULATIONS OF ELECTRONIC RAMAN EFFECTS OF THE NO AND O2 MOLECULES.

Can. J. Phys., 48 (14):1664-1674, July 15, 1970. 16 refs.
D. W. Lepard.
Identifiers: *Raman spectra, *Nitric oxide (no), *Oxygen, Canada, Spectrometry, Electrical properties.

A method is presented for calculating the relative intensities and Raman shifts of the rotational structure in electronic Raman spectra of diatomic molecules. The method is exact in the sense that wave functions used for the calculations may belong to an intermediate case of Hund's coupling schemes. Section II of the paper discusses the basic theory used to obtain rotational energy levels and wave functions. Section III reviews Placzek and Teller's intensity theory for a symmetric loop molecule and adapts it to electronic Raman scattering in diatomic molecules. These results are applied in Section IV to the pure rotational and electronic Raman spectrum of nitric oxide observed by Fast. A similar treatment for the pure rotational spectrum of oxygen is given in Section V.
APTIC-23916

### REDOX CHARACTERISTICS OF CIGARETTE SMOKE.

Chem. Ind. (London), no. 24:800-802, June 13, 1970. 19 refs.
R. C. Benedict, L. Lakritz, E. D. Strange, and R. L. Stedman.
Identifiers: *Cigarettes, *Smokes, *Oxidation, *Reduction, Tobacco, Smoking, Colorimetry, Vapors.

The overall redox characteristics of cigarette smoke were colorimetrically investigated by reacting buffered, aqueous solutions of whole smoke (WS) and its phases with the following dyes: 2,6-dichlorophenol indophenol (DCP), Toluylene Blue and Blue Tetrazolium. Ascorbate and hydrogen peroxide were employed to obtain total reduction or oxidation of the dyes, respectively. Whole smoke and particulate matter (PM) partially reduced DCP and oxidized Toluylene Blue. Vapor Phase (VP) had little visible effect on the dyes. The reducing capacity of the smoke and its phases for DCP was time dependent. A rapid reduction occurred with WS and PM; some slight reduction was also noted with VP after the initial reading.

Particulate matter appeared to be the major contributor to the reducing capability of WS. In all cases, slow reoxidation occurred after a minimum reducing value was obtained. Vapor phase from the smoke of cigarette containing an activated carbon-cellulose acetate filter showed less reducing capacity than VP from an unfiltered smoke. Hydrogen peroxide had a slight effect on VP from filter and nonfilter cigarettes but significantly accelerated the reoxidation step for PM and WS. Peroxidase markedly accelerated the peroxide-smoke reactions from VP, WS, and PM. When the colorimetric redox determinations were compared to electrometric determinations, the major difference was in VP the measured reducing capacity of which was higher than in the colorimetric study.
APTIC-23917

### THEORETICAL STUDY OF SO2 MOLECULAR PROPERTIES.

J. Chem. Phys., 53 (8):3014-3019, Oct. 15, 1970. 29 refs.
Stephen Rothenberg, and Henry F. Schaefer.
Identifiers: *Molecular states, *Quantum mechanics, *Sulfur dioxide, Oxygen, Electric charge, Hydrogen sulfide.

Using two contracted Gaussian functions for each atomic orbital, plus d functions on both sulfur and oxygen to describe molecular charge distortion, a self-consistent-field wavefunction was computed for the ground state of sulfur dioxide. It is estimated that the calculated SCF energy, -547.2089 hartree, lies no more than 0.1 hartree above the Hartree-Fock energy for SO2. An additional calculation with d functions and population analyses indicates that d functions on sulfur are much more important in SO2 than was the case in previous work on hydrogen sulfide and that in SO2 d functions on sulfur are much more important than those on oxygen. Calculated molecular properties are in good agreement with available experimental data. Of particular importance is the fact that the calculated elements of the molecular quadrupole moment tensor are 31%, 30%, and 29% greater than those recently determined experimentally by Pochan, Stone, and Flygare. Values of the third moments, octupole moment tensor, diamagnetic shielding tensor, electric field gradient tensor, and (17) oxygen quadrupole coupling constants are predicted. On the basis of ab initio electric field gradients and experimental (33) sulfur quadrupole coupling constants for OCS, H2S, and SO2 nuclear electric quadrupole moments are deduced. (Author abstract modified)
APTIC-23935

### A SIMPLE, SELF-CONSISTENT ELECTROSTATIC MODEL FOR QUANTITATIVE PREDICTION OF THE ACTIVATION ENERGIES OF FOUR-CENTER REACTIONS. II.

Intern. J. Chem. Kinet., vol. 2:235-255, May 1970. 11 refs.
G. R. Haugen, and S. W. Benson.
Identifiers: *Diatomic molecules, *Electrostatic models, *Activation energies, *Olefins, Mathematical modeling, Hydrogen, Nitrogen, Phosphates, Hydrogen sulfide, Chemical bonds, Water, Reaction kinetics, Thermodynamics.

A simple electrostatic model is described that permits direct calculation of the activation energies for the addition of the molecules of H2O, H2S, H2N, and H3P to olefins. The basic premise of the model is that transition state is partially ionic in character, and that the activation energy has its main contribution from the electrostatic energy necessary in forming a quadrupole from two 'semi-ion' pairs. One semi-ion pair is the polarized olefin; the other is the polarized bond of the diatomic adduct. The activation energy is regarded as a composite of the electrostatic polarization energies required to generate a formal charge separation in each of the reaction bonds, the short-range inter-molecular repulsion, the electrostatic energies regained by the mutual interaction of these polarized bonds, and less the polar energy that might initially reside in the ground state of the reactants. On the average, calculated values agree with observed values to within plus or minus 2 kcal/mole. The best fit is obtained with a polar transition state corresponding to a reduction in bond order from 1 to 1/2 for the bond-breaking coordinates and an increase in bond order from 0 to 0.18 for the bond-forming coordinates. The replacement of a hydrogen atom of the species H2O, H2S, H3N, or H3P by a polarizable methyl group is expected to stabilize the charge on the central atoms. Calculated stablization energies for the pairs H2O- CH3OH, H2S-CH3SH, H3N-CH3NH2, H3P-CH3PH2 are, respectively -4.8, -0.7,-1.9, and 0.8 kcal/mole. (Author abstract modified)
APTIC-23951

### BASIC STUDIES IN GAS-SOLID SUSPENSION. (FINAL REPORT.).

Rutgers-The State Univ., New Brunswick, N. J., Dept. of Mechanical and Aerospace Engineering, 133-MAE-F, 72p, Feb. 1970. 39 refs. CFSTI: NYO-2930-15
Richard L. Peskin.
Identifiers: *Gas-solid suspension, *Heat transfer, Transport, Fluid flow, Dispersions, Gases, Solids.

Gas-solid suspension systems were investigated with respect to fluid mechanisms, gas dynamics, turbulence properties, and scalar transport properties. Information was obtained on Lagrangian properties and general properties of suspension turbulence; and because of the interest in heat transfer systems employing gas-solid suspensions, high and low Reynolds number heat transfer experiments were performed. New forms of correlation parameters for heat transfer data are presented, and the relation of the parameters to controlling mechanisms is discussed. The results show the extreme importance of individual particle dynamics, particularly for those suspensions which are not considered 'nonNewtonian.' For certain combinations of particle loading, particle size, and other particle dynamic parameters, improved heat transfer and reduced friction factor result. In addition, the presence of particles has a significant effect on eddy diffusitivity of turbulence and turbulence structure in the supporting flow. Further work is needed to resolve fundamental inconsistencies in basic equations of motion. It can be shown that the equal and opposite momentum transfer function is inconsistent with the assumption of a finite, that is, nonmolecular size particle phase. Second, it is obvious that solid-particle density distribution in an internal flow is an extremely significant parameter. It determines, among other things, the local interparticle spacing in the boundary layer region and this controls heat transfer and friction factor. Third, in the area of single-particle motion in a turbulent fluid, the effect of external forces is the least understood of all the two-phase flow phenomena. Because it involves intrinsically a solution to the Eulerian-Lagrangian problem, it is unlikely that an exact solution will ever by found. Yet better approximations are needed. (Author summary modified)
APTIC-23953

### EPITAXY OF CLATHRATES.

(Epitassia di Clatrati). Text in Italian. Ann. Chim. (Rome), vol. 48:630-636, 1958. 9 refs.
Enzo Ferroni, and Marco Cocchi.
Identifiers: *Sulfur dioxide, *Hydrogen sulfide, *Chemical reactions, *Organic nitrogen compounds, *Mineral products, Italy, Alcohols.

The clathrates (hydroquinones of methanol, hydrogen sulfide, sulfur dioxide, HCOOH) experience an epitaxy-oriented growth on muscovite mica. The fact that the 1010 plane of the clathrate and the 001 plane of the muscovite are associated offers confirmation for the Willems hypothesis concerning the formation of interphasic bonds. The direction of orientation confirms the symmetrical relationships that one would predict for the ionic components. The original research of the authors, leading to these conclusions, is described.
APTIC-23969

### GEOGRAPHIC CONCENTRATIONS OF THE MANUFACTURING INDUSTRIES.

Inst. for Defense Analyses, Arlington, Va., Program Analysis Div., Contract OCD PS 66 113, Task 4115A, RP-P-594, IDA Log HQ 70-11041, 103p., Sept. 1969. 9 refs. CFSTI, DDC: AD 707415
Leonard J. Bickley.
Identifiers: *Manufacturing industries, *United states, Commercial firms, Personnel, Industrial emission sources.

The extent of geographic concentrations based on employment within the manufacturing industries is explored. Industries are classified at the four-digit Standard Industrial Classification (SIC) level, and individual plants are identified by city location. The number of persons employed is used as a measure of industrial activity, and employment per plant is expressed as a percentage of the national total in a given SIC category. Plants that individually account for more than five percent activity in their respective categories are listed in SIC order showing the estimated percent concentration. In comparison, those manufacturing industries showing no plants with five percent concentration are listed separately. The main data sources for this work were the Dun and Bradstreet listings of plants employing 100 persons or more and the Census of Manufacturers of the Department of Commerce. The work can be used as a guide for future studies of plant concentrations or key facilities. Because it also highlights potentially vulnerable concentrations within the manufacturing industries, the work may be helpful as an aid in evaluating the extent of disproportionate damage to the manufacturing industries as a result of nuclear attack. (Author summary modified)
APTIC-23996

### CONTAMINATION IN A SEMICLOSED ENVIRONMENT - THE MODERN HOME.

Preprint, Institute of Gas Technology, Chicago, Ill., 14p., 1969. 15 refs. (Presented at the Conference on Atmospheric Contamination in Confined Spaces, 5th Annual, Dayton, Ohio, Sept. 1969.)
M. Y. Longley.
Identifiers: *Buildings, *Controlled atmospheres, Aerosols, Domestic heating, Ventilation.

The contamination of the indoor environment of the home - a semiclosed atmosphere system - has only been studied in a perfunctory manner. This highly important element of our total environment is becoming increasingly contaminated by a large number of chemical entities, many having an unknown physiological effect. Aerosol products present a particularly perilous situation because of their modes of use and variety of chemical constituents, including some toxic ones. The problem is further magnified by the growing trend in home design toward closing the system by eliminating fresh air ventilation. A research project, involving the use of two highly instrumented, occupied test homes to define the problem more precisely and to study invironmental control systems has been initiated. The project studies temperature, humidity, outdoor weather conditions, energy consumption, air conditioner operation, dust concentration, and infiltration in the test homes. More scientific investigation into the problem is clearly imperative.
APTIC-24002

### CHEMISTRY OF SULFUR DIOXIDE REDUCTION. THERMODYNAMICS.

Ind. Eng. Chem., vol. 30:92-100, 1938. 11 refs.
Robert Lepsoe.
Identifiers: *Sulfur dioxide, *Reduction, *Thermodynamics, Canada, Methanes, Hydrogen, Carbon monoxide, Carbon disulfide, Condensation, Reaction kinetics, Temperature, Vapor pressure.

The determination of the economics and efficiency of sulfur dioxide reduction to elemental sulfur is a matter of physico-chemical knowledge of the

reactions involved. In this respect, the thermodynamics of the reactions are of as much importance as the kinetics, since they furnish fundamental information regarding the maximum conversions attainable under any prevailing conditions. Reactions involving carbon disulfide, carbon monoxide, hydrogen, and methane are discussed. The influences of condensation, boiling point, vapor pressure, and water vapor are described. In some cases, where the accurately known data refer only to a specific temperature range, the use of the standard free energy equation may introduce considerable error in the final results. Nevertheless, the calculations give information which otherwise would be almost unobtainable.
APTIC-24029

### THE INTERACTION OF SULPHUR DIOXIDE AND HYDROGEN SULPHIDE.

J. Chem. Soc., 1926:2270-2273. 3 refs.
Ernest Matthews.
Identifiers: *Sulfur dioxide, *Hydrogen sulfide, *Reduction, Great britain, Hydrocarbons, Catalytic activity, Liquids.

A study of the interaction of sulfur dioxide and hydrogen sulfide is presented. To bring about the decomposition of a mixture of SO2 and H2S in either the gaseous or the liquid state, it is necessary to add a third substance, and this third substance must be in the liquid phase. Ther is no rigid relationship between the values of the dielectric constants of substances and their chemical activity as measured by their ability to bring about the interaction of H2S and SO2. The activity of a substance in causing decomposition is dependent on the solubility of the two gases in the substance when liquid, or on the solubility of the solids in the liquid mixture of the two gases. Various organic liquids and water are experimentally tested to determine their influence on the interaction of the two gases. The liquids that did and did not induce a reaction are noted. (Author summary modified)
APTIC-24030

### OZONE SYNTHESIS FOR WATER TREATMENT BY HIGH ENERGY RADIATION.

Preprint, American Institute of Chemical Engineers, New York, N. Y., 32p., 1969. 30 refs. (Presented at the American Institute of Chemical Engineers Annual Meeting, 62nd, Washington, D. C., Nov. 16-20, 1969.) CFSTI: BNL-13812
Meyer Steinberg, and Morris Beller.
Identifiers: *Sewage treatment, *Ozone, *Radioactive radiation, Reactors (nuclear).

Ozone can be used effectively in reducing chemical oxygen demand in tertiary treatment of secondary sewage waste effluent, provided an economical production process is available. Commercial quantities cannot be produced photochemically. Results of radiation chemistry studies with a chemonuclear loop that utilizes either reactor neutron and gamma energy or fission fragment energy of uranium-containing alloy foils indicate that G-values for ozone production from oxygen in a high-pressure production facility can range between 10 and 15. These energy values are at least two to three times higher than those obtained by the electric discharge process. Use of isotopic radiation such as the long-lived waste fission product Cs137 can be considered only for treating drinking water or sewage in quantities less than 10 Mgd. The fission fragment chemonuclear process has a large potential for producing hundreds of tons of ozone per day and treating sewage waste effluent in the hundred of Mgd to over a billion gallons per day sizes. At these rates, the cost of ozone production should be at least half that of the electric discharge process. This substantial saving should prompt development of the chemonuclear process for large-volume users of ozone. (Author abstract modified)
APTIC-24041

### PRIMARY PHOTOCHEMICAL PROCESSES IN THE 3660 A PHOTOLYSIS OF 5',7'-DICHLORO-6'-NITRO-1,3,3-TRIMETHYL-INDOLINO-BENZOPYRYLOSPIRAN (I) IN ACETONITRILE.

Preprint, American Chemical Society, Washington, D. C., 31p., 1968. 52 refs. (Presented at the American Chemical Society, 155th National Meeting, San Francisco, Calif., April 1968.)
Helmut Bach, and Jack G. Calvert.
Identifiers: *5',7'-dichloro-6'-nitro-1,3,3-trimethyl-indolino-benzopyrylospiran (i), *Photolysis, Quenching, Spectometry, Polynuclear compounds, Organic nitrogen compounds, Phosphorescence, Photoelectric phenomena, Reaction kinetics, Thermodynamics.

The structural changes effected on irradiation of 5',7'-dichloro-6'-nitro-1,3,3-trimethyl-indolino-benzopyrylospiran (I) are discussed. Quantum yields of the formation of the colored form (II) of the spiropyran (I) are determined for the direct and the sensitized photolysis in acetonitrile solutions at 3660 A and 24 deg (room temperature). The compounds, benzophenone and 2 - acetonaphthone, sensitize the formation of II. Benzil has little effect either as a sensitizer or as a quencher, while 9-flurrenone quenches rather effectively a fraction of the color formation in the direct photolysis of I. From a kinetic analysis of the initial rates of formation of II in the sensitized and quenched reactions, quantitative estimates are made of the quantum yields of the primary reactions involved in the direct photolysis of I. The data suggest that in the direct photolysis at 3660 A, both singlet and triplet excited states of I react to form II. Triplet-energy transfer experiments indicate that the energy of the triplet state of I lies above the ground state by 53-57 kcal/mole; this estimate is reasonably consistent with the observed position of the O-O band (58 kcal/mole) in the phosphorescence spectrum if I. (Author abstract modified)
APTIC-24042

### THE INTERACTION OF HYDROGEN SULPHIDE AND SULPHUR DIOXIDE.

Proc. Chem. Soc. London, vol. 21:158-160, 1905-1907. 4 refs.
William Robert Lang, and Charles Macdonald Carson.
Identifiers: *Sulfur dioxide, *Hydrogen sulfide, *Reduction, Inorganic acids, Chemical reactions, Gases, Water, Reaction mechanisms.

The reaction of sulfur dioxide with hydrogen sulfide is investigated to determine the nature of the reaction products. A heavy yellow deposit is formed when the two gases are mixed for a period of several hours. This yellow material is studied to determine the effect of boiling and cooling, and it is analyzed to determine the constituent compounds. The action of H2S on SO2 produces first sulfur and water, with SO2 present in the sulfur in considerable quantity. The last two substances slowly interact at comparatively high temperatures, giving rise to polythionic acids. An attempt is made to investigate the action of anhydrous liquid H2S on liquid SO2, but the drying of the gases was not thorough enough.
APTIC-24057

### AN ESR STUDY OF SULFUR DIOXIDE AND OXYGEN ADSORBED ON ZINC SULFIDE.

(Ryukaaenjo ni kyuchaku shita nisankaiwo oyobi sanso no ESR ni yoru kenkyu). Text in Japanese. Nippon Kagaku Zasshi (J. Chem. Soc. Japan), 90 (5):445-448, 1969. 10 refs.
Masami Adachi, Toshinobu Imanaka, and Shiichiro Teranishi.
Identifiers: *Spectrometry, *Zinc compounds, *Sulfur dioxide, *Adsorption, Japan, Oxygen, Sulfides, Decomposition, Crystal structure, Temperature.

The adsorption conditon of sulfur dioxide and oxygen on zinc sulfide was investigated by means of electron spin resonance (ESR). In the case of the adsorption of sulfur dioxide at room temperature, strong signals due to SO2 (-) and weak signals due to SO (-) and S (-) appeared, but there was no variation in the signals from the F-center. The ESR measurement at high temperature indicated that adsorbed SO2 (-) decomposes at 200 C and results in oxygen and adhered S (-). It became evident from the spectral variation that the adsorption conditions of oxygen differ according to the adsorption temperatures. After the adsorption of oxygen at room temperature, the evacuation of the gaseous phase of the oxygen led to a 30-50% increase in the signals from the F-center and to a simultaneous increase in the signals from the chemically adsorbed SO (-). However, the evacuation of oxygen at room temperature after 5-6 hour contact with zinc sulfide at 250-300 C resulted in strong signals due to SO2 (-), and there was no increase due to the F-center.
APTIC-24060

### NON-SPECTROSCOPIC METHODS FOR STUDYING GAS PHASE CHARGE TRANSFER COMPLEXES. DIETHYL ETHER-I2 AND TRIMETHYLAMINE-SO2.

Acta Chem. Scand., 24 (5):1836-1837, 1970. 12 refs.
Just Grundnes, Sherril D. Christian, and Venghuot Cheam.
Identifiers: *Complexes, *Ethers, *Iodine compounds, *Amines, *Sulfur dioxide, Europe, Gases, Vapors.

A program was initiated to determine formation constants for charge-transfer complexes by non-spectral methods. Preliminary results are reported for the gas-phase complex of trimethylamine with sulfur dioxide and diethyl ether with iodine. A Burnett-type apparatus and numerical techniques were used to study the isothermal expansion of equimolar mixtures of TMA and SO2. Equilibrium constants at each temperature were inferred by means of a one-dimensional nonlinear least squares program. Values of the complex formation constant Kc and RMSD (the root mean square deviation between calculated and experimental final pressure) are tabulated. In a separate experiment, a fused silica buoyance microbalance was used to determine vapor densities of equimolar mixtures of TMA and SO2 at 35.00 deg and pressure less than 7 torr. Spectrally obtained values of the extinction coefficient 'ec' and the oscillator strength in the vapor phase are reliable; these parameters do not change appreciably with a change in medium. The association of Et2O with I2 at 35.00 deg was investigated with a vapor-phase isopiestic technique utilizing a sensitive fused silica torsion microbalance. The results confirmed previous observations that 'ec' is considerably lower in the vapor phase than in solution. It is concluded that independent accurate determination of Kc by classical methods makes it possible to infer a reliable value of 'ec'. Such results will be essential in testing and developing theories of the effects of solvents on donor-acceptor interactions.
APTIC-24077

### POLLUTION OF ENVIRONMENT, AND COMPUTERS.

(Milieuverontreiniging en computers). Text in Dutch. T. N. O. Nieuws, vol. 25:93-97, 1970. 3 refs.
M. J. Frissel, P. Poelstra, and P. Reiniger.
Identifiers: *Computers, *Simulation, Europe.

Knowledge of several substances that are threats to our environment is often incomplete. Therefore, one can hardly take steps that will be economically efficient. The inherent ecological problems should be studied with the aid of simulation models. These models should be consecutive and thus form a hierarchy. Such a hierarchy implies an added advantage in that models can be evolved for the individual disciplines concerned, preferably by the investigators themselves, and within the field of anyone's given specialization. The entire situation so covered by the hierarchy

can then be more easily evaluated, because the models are conceptually interconnected. (Author abstract modified)
APTIC-24095

### STUDY OF INTERACTION OF AMMONIA WITH NITROGEN OXIDES.

J. Appl. Chem. USSR (English translation from Russian of: Zh. Prikl. Khim.), 43 (1):11-14, Jan. 1970. 3 refs.
S. N. Ganz, and A. M. Vashkevich.
Identifiers: *Ammonia, *Nitrogen oxides, *Chemical reactions, Ussr, Mathematical modeling, Nitric oxide (no), Nitrogen dioxide (no2), Oxygen, Temperature.

An investigation of the effects of temperature and of ammonia, nitric oxide, nitrogen dioxide, and oxygen concentrations in the gas on the rate of interaction of nitrogen oxides (NO plus NO2) with ammonia was conducted. At temperatures above 120 C, the rate of interaction of NH3 with NO increases with a rise of temperature; the process is accompanied by defixation of nitrogen. Under the same conditions, the rate of interaction of NH3 with NO2 falls and the process stops completely at temperatures above 230 C. A mathematical model of the process is derived, and equations for determining the degree of nitrogen defixation under various process conditions are presented.
APTIC-24099

### VIBRATIONAL EXCITATION OF CO BY SLOW-ELECTRON COLLISION.

J. Phys. Soc. Japan, 27 (5):1293-1300, Nov. 1969. 17 refs.
Yukikazu Itikawa, and Kazuo Takayanagi.
Identifiers: *Vibrational excitation, *Carbon monoxide, *Mathematical analyses, *Reaction kinetics, Japan, Electrical properties.

Using the close-coupling method, the vibrational excitation of carbon monoxide by electron collisions was studied. In the present case, the wave function of the whole system is expanded in terms of the rotational and vibrational eigenfunctions of the target molecule; the unknown coefficients appearing in that expansion are functions of the coordinates of scattered electrons and satisfy a set of coupled differential equations. The electron-CO interaction is assumed to consist of dipole, polarization, and short-range electrostatic interactions. First, only the dipole interaction is considered to give rise to the vibrational transition and the result is compared with the Born calculation. The polarization effect is then regarded as responsible for the vibrational transition, and the excitation cross section finally is calculated with both the dipole and the polarization interactions taken into account simultaneously. In the collision-energy range under consideration, the s- and p-waves penetrate rather deeply into the inner region of the potential and are distorted considerably, while d- and higher partial waves are not much distorted. This fact, combined with the predominance of the p-wave contribution, gives rise to a poor agreement between the Born result and the close-coupling calculation. As the incident energy increases, the relative contributions from higher partial waves becomes rapidly larger so that the Born approximation gives a fairly good result. Although the polarization effect depends on the cutoff parameter, its contribution is comparable to that from the dipole interaction. For the incident energy of approximately 0.6 eV or higher the result of the close-coupling calculation agrees better with the experimental value than the Born result; in the lower energy region the close-coupling result much exceeds the experimental value and is even worse than the Born approximation.
APTIC-24128

### ADSORPTION OF CARBON MONOXIDE BY CALCIUM-EXCHANGED ZEOLITE Y.

Trans. Faraday Soc., 66 (573) Part 9:2364-2377, Sept. 1970. 27 refs.
T. A. Egerton, and F. S. Stone.
Identifiers: *Adsorption, *Calcium compounds, *Sodium compounds, *Carbon monoxide, Great britain, Ions, Reaction kinetics, Thermodynamics, Crystal structure.

Carbon monoxide adsorption on sodium yttrium (-23 to 45 C) obeys Henry's law and the isosteric heat of adsorption is low. As sodium ions are replaced by calcium ions, the adsorption on the outgassed zeolite remains non-specific with little change until 50% of the sodium ions have been replaced. At 50-55% exchange, a more specific type of carbon monoxide adsorption develops. The heat of adsorption rises abruptly to 40-45 kJ/mol, and the entropy of adsorption shows that the CO molecules are more localized. The specific adsorption obeys the Langmuir isotherm and the uptake in this adsorption mode progressively increases as further sodium ions are replaced by calcium ions in the range 55-87% exchange. Calcium ions introduced into NaY by aqueous ion exchange preferentially enter internal sites on subsequent dehydration. Beyond 16 calcium ions per unit cell (55% exchange), which corresponds to 100% occupation of site I or to 50% occupation of site I', further exchange results in calcium ions occupying locations exposed to the supercages (site II), as shown by the onset of specific adsorption of CO. The limiting quantity of specific adsorption on zeolite outgassed at 350 C, determined from the Langmuir isotherm, corresponds closely to one molecule of CO per exposed calcium ion. The work establishes that CO is a sensitive probe molecule for investigating the location of unshielded multivalent cations in zeolites. (Author abstract modified)
APTIC-24134

### EFFECTS OF HIGH ROTATIONAL QUANTUM NUMBERS ON RYDBERG-KLEIN-REES FRANCK-CONDON FACTORS: THE NITRIC OXIDE (NO) BETA BAND SYSTEM.

J. Chem. Phys., 53 (8):3147-3152, Oct. 15, 1970. 20 refs.
John I. Generosa, and Richard A. Harris.
Identifiers: *Quantum numbers, *Transition states, *Nitric oxide (no), Spectrometry, Electrical properties.

Rydberg-Klein-Rees (Franck-Condon factors) are calculated for the nitric oxide beta band system incorporating high vibrational and rotational quantum numbers and accounting for spin-orbit couplings and centrifugal distortions. Franck-Condon factors calculated using the rotationless potential indicate that some of these may differ appreciably (in some cases by more than a factor of 2) when compared with factors calculated with J equals 60. Franck-Condon factors calculated for specific bands, but for separate fine structure components were often quite different. Adding the rotational contribution directly to the rotationless potential to form an effective potential, as is usually done within the framework of the Born-Oppenheimer approximation, may not be appropriate for some systems. (Author abstract modified)
APTIC-24135

### INTERACTIONS OF GASEOUS AIR POLLUTANTS WITH EGG LECITHIN AND PHOSPHATIDYL ETHANOLAMINE MONOMOLECULAR FILMS.

Atmos. Environ., 4 (3):311-319, May 1970. 8 refs.
A. Felmeister, M. Amanat, and N. D. Weiner.
Identifiers: *Lecithin, *Phosphatidyl ethanolamine, *Membranes, *Nitrogen dioxide (no2), Lipids, Pulmonary edema, Trans-2-butene, Ethylene, Organic phosphorus compounds, Reaction mechanisms.

Interaction of egg lecithin and phosphatidyl ethanolamine monomolecular films with nitrogen dioxide containing atmospheres was studied. Solutions of EL in ethanol-hexane and PE in ethanol-hexane were spread on 0.9% sodium chloride using an Agla micrometer syringe. These films were studied while exposed to air flowing at the rate of 300 ml inverse min or to the following test atmospheres: 0.33% nitrogen dioxide in air, 0.33% ethylene in air, 0.08% trans-2-butene in air, 0.33% nitrogen dioxide and 0.08% trans-2-butene in air, and 0.33% nitrogen dioxide and 0.33% ethylene in air. Surface pressure readings were then obtained at various film areas. All the mixtures which contain NO2 markedly affect the EL film, but neither the ethylene nor the trans-2-butene exhibited any interaction with EL. Addition of the olefins to the NO2 mixtures did not influence the EL-NO2 interaction. The initial state of the film appeared to affect the extent of the NO2-EL film interaction. At all surface pressures studied, the EL interaction with NO2 was significantly less than the PE-NO2 interaction. Whereas the fatty acid composition of EL consists primarily of a saturated and an unsaturated fatty acyl chain, most of the fatty acyl chains of the PE molecules are polyunsaturated. Their differences in structure apparently result in lesser cohesion between the polyunsaturated fatty acyl chains in the PE monolayers. The extent of interaction of NO2 with the phospholipids studied increased with increasing unsaturation of the phospholipid and with decreasing initial surface pressure of the film. NO2, in both the gas phase above the film and liquid phase below the film, interacted with phospholipids. If a similar situation occurred on exposure to the lung to NO2, in vivo, one might expect an expansion of the alveolar capillary membranes with a subsequent increase in their permeability, finally resulting in pulmonary edema. (Author abstract modified)
APTIC-24146

### THE DISSOCIATION OF DINITROGEN TETROXIDE IN THE LIQUID PHASE.

J. Chem. Soc., vol. 13:2191-2193, 1970. 11 refs.
A. J. Vosper.
Identifiers: *Dinitrogen tetroxide, *Dissociation, Great britain, Spectrophotometry, Spectrometry, Nitrogen oxides, Nitrogen dioxide (no2), Liquids, Reaction kinetics, Temperature.

Dissociation of liquid dinitrogen tetroxide was studied between 263 and 333 K by two different experimental methods, and the results were compared with previous work. By measuring the change in optical density with temperature from 400 nm to longer wavelengths at the low-energy tail of the nitrogen dioxide absorption band, the equilibrium constant in terms of concentration K (c) for the reaction N2O4 to 2NO2 was obtained. The concentration of NO2 was calculated by use of the Beer-Lambert law and was reasonably constant between 425 and 475 nm. As one proceeded to longer wavelengths, the calculated concentration fell steadily, which explains why the present results give higher values for K (c) than a previous spectrophotometric study. Nitrogen dioxide concentration was also calculated by measuring the change of magnetic susceptibility with temperature.
APTIC-24148

### PYROLYSES IN THE PRESENCE OF NITRIC OXIDE. PART I. ETHANE.

J. Chem. Soc., vol. 13:2329-2332, 1970. 19 refs.
G. B. M. Eastmond, and G. L. Pratt.
Identifiers: *Ethane, *Nitric oxide (no), *Pyrolysis, Great britain, Mass spectrometry, Methanes, Hydrogen, Nitrogen, Reaction kinetics, Reaction mechanisms, Temperature.

The formation of hydrogen, methane, and nitrogen during the very early stages of the pyrolysis of ethane in the presence of nitric oxide was studied. An AEI MS10 mass spectrometer was used for the analyses. Inhibition curves for these products from ethane at 100 Torr and for nitric oxide at pressures between 0 and 300 Torr were determined at 8 temperatures between 554 and 603 C. The rates of formation of hydrogen followed the hyperbolic law closely at all temperatures; at all temperatures, the curve became essentially linear at high concentrations of nitric oxide. By the method of least squares, activation energies with

methane were 88.5 plus or minus six and 74.5 plus or minus 7 kcal inverse mol. The order of reaction with respect to nitric oxide for nitrogen formation increased steadily with fall of temperature, from close to unity at 600 C to nearer 1.2 at 550 C. A new mechanism for the formation of nitrogen is proposed that is based on the low-temperature mechanism of nitric oxide disproportionation by alkyl radicals. Also, a new termination reaction is proposed for the principal chain ending step in the presence of nitric oxide. (Author abstract modified)
APTIC-24149

### THE STRUCTURE OF RANEY NICKEL. III. THE CHEMISORPTION OF HYDROGEN AND CARBON MONOXIDE.

J. Catalysis, 18 (3):243-248, 1970. 12 refs.
J. Freel, S. D. Robertson, and R. B. Anderson.
Identifiers: *Adsorption, *Hydrogen, *Nickel compounds, *Carbon monoxide, Canada, Nitrogen, Aluminum oxides, Catalytic activity, Hydrogenation, Surface properties.

Chemisorption of hydrogen and carbon monoxide at -195 C was measured on several different preparations of Raney nickel, and the fraction of the surface as nickel was estimated. The volumes of strongly chemisorbed hydrogen determined as ($H_2$ (I) - $H_2$ (II)) and ($H_2$ (I) - $H_2$ (III)) were 10.8 and 8.5 ml STP/g, respectively. Carbon monoxide and nitrogen isotherms indicate a CO chemisorption of 16.1 ml STP/g when calculated as (CO (I) - CO (II)) and 18.0 ml STP/g calculated as (CO (I) - $N_2$ (II)). Volumes of $H_2$ and CO chemisorbed by the various samples are presented tabularly, together with an estimate of catalytic activity for cyclohexene hydrogenation. From CO chemisorption, assuming a cross-sectional area of 13 A squared, the fraction of the surface as nickel varies from 55 to 85% for conventional preparations. The fraction of surface as nickel decreased with increasing alumina content. Prolonged heating of a catalyst in boiling water decreased the nickel area to 1/6 of the original value with the total area decreasing to 2/3. No correlation was found between nickel area and activity in the hydrogenation of cyclohexene in ethanol at 30 C except that activity of the sample treated with boiling water was low. (Author abstract modified)
APTIC-24152

### ADDITION OF DINITROGEN TRIOXIDE TO NONCONJUGATED DIENES.

J. Org. Chem., 35 (8):2785-2790, 1970. 10 refs.
M. L. Scheinbaum.
Identifiers: *Dienes, *Nitrous anhydride (n203), *Chemical reactions, Olefins, Nitrogen oxides, Chemical bonds, Free radicals, Reaction mechanisms.

The addition of dinitrogen trioxide proceeds selectively at the bicyclic double bond of dicyclopentadiene. Simple adduct formation without transannular reaction occurs with 1,5-cyclooctadiene; however, norbornadiene undergoes transannular addition to give nortricyclene derivatives. Reduction of the adducts lead to hydroxylamino oxime derivatives and diamines. The course of addition of nitrogen oxides is interpreted by a free-radical pathway. (Author abstract)
APTIC-24165

## 7. EFFECTS - HUMAN HEALTH

### DETERMINATION OF PARTICLE SIZE DISTRIBUTION OF SELECTED AEROSOL COSMETICS. I. HAIR SPRAYS.

For primary bibliographic entry see Field 03.
APTIC-18284

### RESPIRATORY DISEASE IN AN URBAN ENVIRONMENT.

Ind. Med. Surg., 38 (4):126-131, April 1969. 2 refs.
Mark H. Lepper, Norio Shioura, Bertram Carnow, Samuel Andelman, and Leah Lehrer.
Identifiers: *Respiratory diseases, *Chicago, *Sulfur dioxide, *Socio-economic factors, *Mortality, Diseases and disorders, Bronchitis, Bronchopneumonia, Emphysema, Influenza, Pneumoconiosis, Tuberculosis, Illinois, Urban areas, Exposure methods, Sulfur oxides, Administrative and social.

Effects of $SO_2$, on the Chicago population during one year were studied. Respiratory disease mortality was compared within socioeconomic groupings. From 1964 through 1965, a trend was found toward higher respiratory disease mortality in the lower socioeconomic groups. When the effect of increasing $SO_2$ exposure was analyzed for each class, however, data were less consistent. Race, sex, and age were taken into consideration, and final results indicated that socioeconomic level and exposure to $SO_2$ are important factors in the incidence of respiratory diseases.
APTIC-18291

### THE ROLE OF URBAN AIR POLLUTION AS A PUBLIC HEALTH PROBLEM.

N. Y. Med., 24 (10):524-531, Oct. 1968. 10 refs.
Stephen M. Ayres.
Identifiers: *Epidemiology, Carboxyhemoglobin, Cardiovascular diseases, Bronchitis, Pulmonary edema, Meteorology, Hydrocarbons, Carbon monoxide, Nitrogen dioxide (no2), Sulfur dioxide, Ozone, Sulfates, Acute, Chronic.

Several air pollutants and their relationship to public health are discussed. Gaseous sulfur dioxide is not believed to be as irritating to the tracheobronchial tree as sulfur trioxide, sulfuric acid mist, or sulfur particles. Small particles of metal sulfate salts are very irritating, and indicate that the major action of $SO_2$ may be as a precursor of more hazardous pollutants. Sulfur dioxide adsorbed on carbon particles also appears to be more harmful than gaseous $SO_2$ alone. Nitrogen oxides result from combustion of fuel in automobiles and furnaces. Short exposure to high concentrations of nitrogen dioxide causes acute pulmonary edema, while longer exposure to low concentrations causes bronchitis and bronchiolitis obliterans. Recent studies have indicated that levels of carboxyhemoglobin saturation under 5% may impair intellectual processes. Small concentrations may also have a deleterious effect on the myocardium of patients with coronary artery disease. It is believed that the observed health effects are due to the complex interacting mixture of pollutants rather than to specific substances. Epidemiologic studies reveal two distinct biological effects. Short term exposure to high level pollutants may increase illness and death rate, while long term exposure to lower levels may increase the incidence of specific diseases. Weather conditions that can lead to air pollution episodes, and the role of the physician in such episodes are also discussed.
APTIC-22184

### PLEURAL CALCIFICATION AS A ROENTGENOLOGIC SIGN OF NON-OCCUPATIONAL ENDEMIC ANTHOPHYLLITE-ASBESTOSIS.

Acta Radiol., Suppl. 194:1-67, 1960. 77 refs.
Raimo Kiviluoto.
Identifiers: *Calcification, *Asbestosis, *Radiography, Mortality, Pathological techniques, Autopsy, Lungs, Pneumoconiosis, Europe, Dusts, Mining, Calcium compounds.

An investigation was conducted into the incidence of cases with pleural calcification without an adequate history of pulmonary or pleural disease or injury. Between 1957 and 1959, 126 cases of pleural calcification of this kind were found among 39,000 roentgen examinations of the chest. Roentgenologically, inhalation damage appeared probable, but there was no clinical symptoms of pneymoconiosis or history of occupational exposure to dusts. Calcification in these cases had a different character than that due to disease; the deposit was located on the parietal pleura and usually occurred bilaterally. Basal and mediastinal calcification was also observed, but there was no interlobular calcification. Clinically the patients had no subjective or objective respiratory symptoms. The salient feature was the endemic occurrence of the majority of the cases in the Kuusjaervi commune in Finland. Two anthophyllite asbestos mines are located near the center of this area. These provide the common external factor, asbestos, which has considered the most probable causative factor. Some histopathologic and mineralogic examinations were made to confirm the etiology and pathogenesis; fibrous asbestos was identified in the lung of one autopsied case. A theory as to the pathogensis of calcium deposits is presented. A survey of the literature, with reference to pleural calcification and pneumonoconioses, is also included. (Author summary modified)
APTIC-22195

### CHRONIC NONSPECIFIC RESPIRATORY DISEASES IN THE CITY OF CRACOW. VIII. FISHER'S DISCRIMINANT FUNCTION IN THE ANALYSIS OF THE INFLUENCE OF SMOKING ON PREVALENCE OF SYMPTOMS.

Przeglad Epidemiol., 23 (1-2):159-165, 1969. 4 refs.
Translated from Polish. Central Inst. for
Scientific, Technical and Economic Information,
Warsaw (Poland), Scientific Publications Foreign
Cooperation Center. CFSTI: TT 69-50001/1-2
Jerzy Kucewicz.
Identifiers: *Smoking, *Bronchitis, *Fisher's discrimanant function, Humans, Epidemiology, Cough, Europe, Urban areas, Statistical analyses, Questionnaires, Chronic.

One of the aims of the epidemiologic survey of nonspecific respiratory diseases in the citizens of Krakow was to discover factors contributing to the occurrence of chronic bronchitis. In a pilot study conducted in one of the districts of the city, 533 persons were interviewed by means of a uniform questionnaire. The diagnoses established included chronic bronchitis syndrome, chronic cough syndrome, and healthy persons. The respondents were divided into three groups: present smokers, persons who had stopped smoking, and nonsmokers. The proportions of persons with chronic bronchitis syndrome and chronic cough syndrome among the present smokers were significantly higher than in the other two groups. The questionnaire was designed to provide information on three characteristics: period of smoking in years, age at time of starting smoking, and number of cigaretts smoked daily. By applying the chi square test to the data, the period of smoking and the number of cigarettes smoked daily were related to the presence of symptoms. The applicability of Fisher's discriminant function analysis, which evaluates the relative importance of variables as predictors of symptoms, to analysis of the relationship between the three characteristics of smokers and bronchitis symptoms was tested. This method will be used in a cross sectional study to determine the influence of these characteristics on the prevalence of symptoms and their combinations.
APTIC-22199

### THE DEVELOPMENT OF LEAD POISONING.

(Die larvierte Bleivergiftung). Text in German.
Arch. Hyg. Bakteriol. (Munich), 152 (5):551-558, June 1968. 65 refs.
D. Stoefen.
Identifiers: *Epidemiology, *Fuel additives, *Lead compounds, Costs, Toxicity, Germany, Tetraethyl lead.

The sanitation of the biosphere in the sense of microtoxicology would involve considerable expenses. Byrne of the American Union Oil Company estimates that investments of $5,680,000,000 would become necessary if the USA prohibited the addition of lead to gas. The German Federal Republic is far removed from a disclosure of Soviet technology. It can only hope that the results of Soviet research reach it by way of the USA, whose Public Health Service deals with these results in a comprehensive research program.

Sweden has already prohibited the addition of lead to fuel on the basis of these results. The American research program requires approximately four years, the conversion of the petroleum industry another four years. It is questionable whether the system can bear this load for another eight years. At present, even the symptoms are not recorded. There is good reason to assume that at least 30% of the functional diseases are due to lead and that at least 25% can be healed by specific medical treatment. The blocking of numerous enzymatic and biosynthetic processes summarized by Bersin in 1966 should be taken into consideration. (Author abstract)
APTIC-22222

### TISSUE RESPONSE TO INTRAPERITONEAL ASBESTOS WITH PRELIMINARY REPORT OF ACUTE TOXICITY OF HEAT-TREATED ASBESTOS IN MICE.

Environ. Res., 1 (3):217-230, 1967. 9 refs.
Juraj Jagatic, M. E. Rubnitz, M. C. Godwin, and Robert W. Weiskopf.
Identifiers: *Fibrosis, *Toxicity, *Digestive system, *Asbestos, Mice, Mortality, Cells, Tissues, Asbestosis, Tumors, Temperature.

Mesothelial-cell response to asbestos fibers was studied to determine whether this tissue undergoes malignant change or, if a neoplasm did not result, if there would be some other distinctive lesion that can be attributed to asbestos fibers. Of the 162 mice studied, 118 were injected with asbestos and 44 with talc. Animals were sacrified at six different time intervals, and post mortem examination was performed and several sections were taken for histological examinations. Intraperitoneal asbestos not only produced fibrosis, but a special and peculiar type of fibrosis which was proliferative, granulomatous and invasive, and histologically similar to mesothelioma, although morphologic evidence of actual malignancy was not obtained. Further, asbestos fibers exposed to high temperature produced high degree of toxicity in white mice, resulting in a 60% mortality rate. (Author abstract modified)
APTIC-22224

### CARBON MONOXIDE POISONING -- A TIMELY WARNING.

New Engl. J. Med., 278 (15):849-850, April, 11, 1968. 4 refs.
Personal Author Not Recorded.
Identifiers: *Nervous system, *Carbon monoxide, Thresholds, Health impairment.

Carbon monoxide is an odorless, colorless, and tasteless gas that acts in an insidious way similar to hypoxia. As documented by a recent article, neurologic sequelae can follow acute exposures to relatively high concentrations. Because such exposures can lead to severe brain damage, the hazards of acute intoxication bear continued discussion. However, more attention must be paid to the possible effects of relatively low levels of the pollutant. Another recent report has demonstrated behavioral impairment associated with levels of exposure in the range accepted as tolerable in industry. The results indicate that impairment of cerebral function can occur at extremely low levels (50-250 ppm) during exposures of only half hour to two and a half hours. Further support for central nervous system effects comes from still another study showing that low levels of carbon monoxide can significantly raise the threshold of light sensitivity of the eye. In the United States, exposure to carbon monoxide may occur in industry around coke ovens and steel processing plants. But the two major sources of carbon monoxide in North America are the automobile and the cigarette.
APTIC-22231

### THE THREAT POSED BY DUST AND INDUSTRIAL GASES EMITTED BY CENTRAL HEATING PLANTS AND OTHER AIR POLLUTION SOURCES.

(Peligrosidad de los polvos y gases industriales, emitidos por las centrales termicas y otras fuentes de contaminacion del aire). Text in Spanish. Quim. e Ind. (Bilbao), 14 (6):195-206, Nov.-Dec. 1967. 21 refs.
Jose M. Portierra.
Identifiers: *Heating plants, *Respiratory diseases, Air pollution episodes, Lung cancer, Europe, Dusts, Coal, Industrial emission sources, Stacks, Particle size, Electrostatic precipitators, Height finding, Carbon dioxide, Carbon monoxide, Sulfur dioxide.

Summarized and discussed are the dangers to human lungs from the particulate content of industrial emissions, as well as calculation of chimney height, use of purification equipment, and the harmful effects of gaseous pollutants (carbon dioxide, carbon monoxide, and sulfur dioxide). A study by a local agency in Oviedo, Spain, of the atmospheric dust content in the immediate vicinity of a large central heating plant using low quality coal at the rate of 1200 tons per day, showed an output of 1200 dust particles per cu cm of air, 170 of which were of a diameter smaller than 7 microns. The Spanish city of Aviles formerly received 350 tons of fine coal dust from the central heating plant of ENSIDESA. After reports were received of high incidence of lung diseases and lung cancer, electrostatic filters were installed, 99% effective, which considerably alleviated the health problems in that city. There is still much public apathy concerning air pollution in Spain.
APTIC-22246

### THE PATHODYNAMICS OF HEMOPOIESIS SUPPRESSION BY NITROUS OXIDE.

Anesthesia Analgesia Current Res., vol. 45:461-465, July-Aug. 1966. 6 refs.
Robert D. Barnard.
Identifiers: *Anesthesia, *Hemopoiesis, *Carcinogens, *Nitrous oxide (n2o), Treatment and aids, Blood cells, Cancer.

Hemopoietic marrow suppression following nitrous oxide anesthesia is discussed along with the latter's propensity for carcinogenic-teratogenic activity via its conversion to hyponitrite. The mechanism of nitrous oxide's teratogenic activity indicates the fatuity of using it in radiomimetic therapy for cancer. The same common-sense considerations apply in nitrous oxide use as apply in desirable or enforceable radiation restrictions. There is a lower, asymptotic limit in either because there may be such a thing as 'background' nitrous oxide. The gas is produced by upper atmosphere ionization, possibly by automobile exhausts, and certainly by disintegration of commerically dispensed whipped cream. Conceivably, a single nitrous oxide molecule could, while in a suitable resonance state, be hydrated to a hyponitrous acid ion in proper proximity to the appropriate gene the denaturation of which would trigger a cancer. The chances for such an occurrence are calculable from an intricate equation which yields a Boltzmann distribution. It is suggested that the practical degree to which such a probability would limit the use of nitrous oxide as an anesthetic might be the basis for a retrospective study.
APTIC-22262

### CHEMICAL CARCINOGENS AND RESPIRATORY EPITHELIUM.

California Univ., Berkeley, Proc. Berkeley Symp. Math. Statistics Probability, 5th, Calif., 1965 and 1966, p. 639-648. 6 refs. (June 21-July 18, Dec. 27-Jan. 7.)
T. Timothy Crocker, and Beryl I. Nielsen.
Identifiers: *Epithelium, *Cell metabolism, *Carcinogens, Rats, Tissue cultures, Cells, Trachea, Anthracenes, Pyrenes.

Suckling rat trachea were maintained in organ cultures and the tissues treated with 7,12-dimethylbenz (a)anthracene (DMBA), benzo (a)pyrene (BaP), benzo (e)pyrene (Bel') or 3-methylcholanthrene (MC). The tissues were then given thymidine or 3H-BaP and, to detect cells synthesizing DNA, examined by autoradiographic methods. The data obtained indicate a proliferative response, i.e., an increased proportion of cells labeled with 3HT, presumably on behalf of DBA synthesis, occurs among basal cells before the differentiated columnar cells are killed by exposure to DMBA. They also show the rapid penetration of labeled BaP into columnar and basal cells. Two hypotheses are advanced to explain the present and earlier data: carcinogenic hydrocarbons enter cells which are in active protein synthesis as a feature of the function of differentiated cells or as a feature of cell replication; and toxic actions of the hydrocarbon are exerted in both situations to (a) stop differential cells from inhibiting basal cell replication and (b) to cause a disproportion between the number of basal cells synthesizing DNA and the number reaching actual mitosis.
APTIC-22267

### EXPERIMENTAL HUMAN EXPOSURE TO CARBON MONOXIDE.

Preprint, Marquette Univ., Milwaukee, Wis., Dept. of Environmental Medicine, 25p., 1970. 10 refs.
Richard D. Stewart, Jack E. Peterson, Edward D. Baretta, Romeo T. Bachand, and Michael J. Hosko.
Identifiers: *Humans, *Carboxyhemoglobin, *Carbon monoxide, Blood chemistry, Circulatory system, Eyes, Alveoli, Toxicity, Toxic tolerances, Headache.

A study was conducted to gather human toxicological information about carbon monoxide. Volunteers were exposed to CO at concentrations ranging from 1 to 1000 ppm. The CO concentration in the exposure chamber was continuously recorded by an infrared spectrometer. The chamber atmosphere was also monitored periodically by a gas chromatogram equipped with a helium ionization detector. No adverse effects were observed in sedentary males exposed to 100 ppm for 8 hours. Exposures producing carboxyhemoglobin saturations greater than 15% to 20% resulted in delayed headaches, changes in visual response, and impairment of manual coordination. The alveolar breath CO was analyzed by infrared sprectrometry and gas chromatography. The COHb was determined by gas chromatography and the Co-Oximeter method. The ability to confirm each blood and breath CO concentration during and following the exposures to known CO concentrations provided data with which to mathematically express the absorption and excretion of CO by the subjects.
APTIC-22268

### THE POST-EXPOSURE RELATIONSHIP OF CARBON MONOXIDE IN BLOOD AND EXPIRED AIR.

Preprint, Marquette Univ., Milwaukee, Wis., Dept. of Environmental Medicine, 7p., 1970. 7 refs.
Jack E. Peterson.
Identifiers: *Carboxyhemoglobin, *Hemoglobin interactions, *Retention, *Carbon monoxide, Males, Blood vessels, Alveoli.

The relationship between the carboxyhemoglobin concentration in human blood and the carbon monoxide concentration in expired air was investigated. The experiments involved exposure of Caucasian males to carefully controlled CO concentrations. Venous blood samples for COHb and alveolar breath samples for CO were obtained during both the absorption and the excretion phases of the exposures. During absorption, the CO concentration of the exhaled air was a function of the ambient CO concentration and the COHb in the blood. During the elimination phase, when the ambient CO concentration was less than 1 ppm, the alveolar breath CO concentration appeared to be entirely dependent on the COHb concentration.

This relationship was non-linear. It is concluded that alveolar breath analysis can be used to accurately estimate the percent COHb saturation in adult, Caucasean males provided the ambient CO concentration is near zero.
APTIC-22269

### ABSORPTION AND ELIMINATION OF CARBON MONOXIDE BY INACTIVE YOUNG MEN.

Preprint, Marquette Univ., Milwaukee, Wis.,
Dept. of Environmental Medicine, 20p., 1970. 12
refs.
Jack E. Peterson, and Richard D. Stewart.
Identifiers: *Males, *Hemoglobin interactions, *Carbon monoxide, Carboxyhemoglobin, Blood cells, Absorption, Mathematical analyses.

Human volunteers were exposed to carbon monoxide ranging from 1 to 1000 ppm. Venous blood samples for carboxyhemoglobin and total hemoglobin analysis were obtained serially from each subject in an uncontaminated atmosphere. Hemoglobin concentration and the CHOb percentage were determined in a Co-Oximeter. The CO liberated from the COHb was measured with a helium ionization detector. Data gathered during the experiments were used to define absorption and excretion properties. Excretion of CO from the blood was a half-life phenomenon. The half-life of COHb ranged from 128 to 409 minutes, with an average of 320 minutes. Several mathematical models were tested to determine their usefullness in relating COHb to level and duration of exposure. Empirical equations describing these relationships were formulated.
APTIC-22270

### STRAIN SENSITIVITY OF RATS TO NITROUS OXIDE.

Anesthesia Analgesia, Current Res., 47 (5):509-
514, Sept.-Oct. 1968. 11 refs.
Cloid D. Green.
Identifiers: *Blood cells, *Nitrous oxide (n2o), Rats, Hematology, Nervous system, Cell growth.

The sensitivity of different strains of rats to nitrous oxide is discussed. The strains of rats studied were Sprague-Dawley, Buffalo, Fischer, Wistar, and Long-Evans. An F1 generation of cross bred wild rats and Sprague-Dawley rats was also studied. Differential white blood cell counts were done on smears of peripheral blood from 50% of the rats of each group. All control animals had a normal lymphocytosis of 65-80%. Experimental animals of the Sprague-Dawley, Buffalo, and Fischer strains also had lymphocytosis of a normal range. The Wistar and Long-Evans rats, which had been exposed to 70% N2O for eight days, had an increased lymphocytosis in their peripheral blood. It is believed that the sensitivity of the hemopoietic system is associated with alertness, aggressiveness, and the characteristics of wild animals. Sensitivity to N2O is also thought to depend on rapid rate of cell reproduction and not on strain. No correlation could be found between sensitivity of the hemopoietic system and sensitivity to the analgetic properties of the gas.
APTIC-22277

### EFFECTS OF CARBON MONOXIDE EXPOSURE ON THE ARTERIAL WALLS.

Preprint, New York Academy of Sciences, New
York, 19p., 1970. 21 refs. (Presented at the
Conference on Biological Effects of Carbon
Monoxide, New York, Jan. 12-14, 1970.)
Poul Astrup, Knud Kjeldsen, and John Wanstrup.
Identifiers: *Blood vessels, *Carbon monoxide, Rabbits, Carboxyhemoglobin, Lipids, Proteins, Blood pressure, Smoking, Cardiovascular diseases, Hypoxia, Europe, Nitrogen, Oxygen.

Discussion of the relationship between smoking and the development of arteriosclerosis, has focused attention on the influence of nicotine on the cardiovascular system while the carbon monoxide in tobacco smoke has not been considered to have any pathogenic importance. In animal experiments, however, it has not been possible to prove an atherogenic effect of nicotine. Rabbits were placed in airtight chambers through which various mixtures of ambient air and CO, oxygen, or nitrogen could be led. The cholesterol content of the aorta in cholesterol-fed animals continuously exposed to CO with the concomitant elevation of carboxyhemoglobin for 10 weeks was 2.5 times higher than in the controls. The controls had not been exposed to CO, but had been fed cholesterol. The animals were exposed to 10% oxygen for 8 weeks, and 3.5 times higher concentrations of cholestrol were observed in the exposed animals. Also, without giving the rabbits cholesterol, it was possible to induce arterial lesions by CO exposure. It was concluded that rabbits could develop vascular lesions by exposure to CO and to hypoxia, which could not be distinguished from spontaneous arteriosclerosis. Cholesterol feeding is believed to have led to a considerable increase of lipid accumulation. These findings are related to the pathogenic mechanisms of arteriosclerosis development in man.
APTIC-22285

### CHRONIC NONSPECIFIC RESPIRATORY DISEASES IN THE CITY OF CRACOW. V. RELIABILITY OF INTERVIEWS.

Przeglad Epidemiol., 23 (1-2): 65-76, 1969. 17 refs.
Translated from Polish. Central Inst. for
Scientific, Technical and Economic Information,
Warsaw (Poland), Scientific Publications Foreign
Cooperation Center. CFSTI: TT 69-50001/1-2
Feliks Sawicki.
Identifiers: *Epidemiology, *Diagnosis, *Data analysis, *Questionnaires, Humans, Morbidity, Bronchitis, Cough, Europe, Sampling methods, Statistical analyses.

Diagnostic tests used in epidemiologic studies should be simple, valid, and give reproducible results. With respect to studies on chronic bronchitis, interviews, by means of uniform questionnaires, are used to establish diagnosis. Verification of the validity of the interview by medical examination is of little value because of the discrepant views on chronic bronchitis and lack of clinical diagnostic methods. Therefore, the validity of the studies depends on the reproducibility of the information obtained. This reproducibility can be defined by studying the responses of the same person interviewed twice. Analysis of the influence of age, sex, occupation, and duration between interviews revealed that older women most often gave discrepant replies to questions about past diseases. The marked discrepancy in the dates of appearance of cough, phlegm production, breathlessness, and past history of bronchitis shows that the subjects attach little importance to these symptoms. The lack of attention to these symptoms may influence the validity of information and final conclusions, which may be based on too low morbibity rates. Comparison of the total results of the first and second interviews of 48 persons showed no significant differences. It was concluded that collecting interviews in a group as a measurement method gives valid results.
APTIC-22295

### AEROALLERGENS AND PUBLIC HEALTH.

In: Advances in Environmental Science, vol. 1,
New York (*), John Wiley, 1969, p. 197-236. 204
refs.
William R. Solomon.
Identifiers: *Allergies, *Aeroallergens, Immunology, Respiratory diseases, Microorganisms, Transport.

Literature on the health effects of aeroallergens is discussed under the main headings of allergic mechanisms, allergic populations (atopic and nonatopic) at risk, the nature and sources and transport of aeroallergens, aeroallergens in atopic diseases, and aeroallergens in nonatopic diseases. Antibody and cell-dependent mechanisms are included, as well as the antibody response in hayfever and asthma. The prevalence of symptoms is discussed, particularly in relation to atopic persons. Of the great variety of airborne materials, a limited number are mentioned as important determinants in atopic allergy: house dust, pollens, fungi, and animal emanations. Methods of sampling airborne spores and making pollen counts are reviewed. The 'Farmer's Lung' group of diseases and allergic contact dermatitis are also discussed.
APTIC-22303

### INVESTIGATIONS ON THE RELATIONS BETWEEN DISEASES OF THE RESPIRATORY TRACT AND AIR POLLUTION.

(Richerche sui rapporti tra mallattie dell 'apparato
respiratorio ed inquinamenti atmosferici). Giorn.
Igiene Med. Prevent. (Genoa), vol. 3:255-289,
1962. Translated from Italian. Franklin Inst.
Research Labs., Philadelphia, Pa., Science Info.
Services, 49p., Nov. 6, 1969.
Fernando Luigi Petrilli, and Guiseppe Agnese.
Identifiers: *Epidemiology, *Respiratory diseases, Adults, Age, Morbidity, Smoking, Cardiovascular diseases, Bronchitis, Cough, Italy, Industrial areas, Residential areas, Dusts, Industrial emission sources, Non-industrial emission sources, Statistical analyses, Sulfur dioxide, Questionnaires.

Direct determinations were made in four zones in Genoa, Italy different in air pollution by means of a questionnaire, to determine the frequency of respiratory diseases in subjects over 64 years of age. After considering the possible influence of age, length of residence, heart conditions, living habits, and previous work activities, the percentage frequency indices of coughing, expectoration, rhinitis, dyspnea, and recent and remote respiratory diseases were calculated. The more important comparisons were those relating to female subjects. A correlation was found between the incidence of respiratory symptoms and diseases and the extent of air pollution. Lower indices were found for the data determined in the less polluted residential area, especially the frequency of coughing, expectoration, dyspnea, rhinitis, and previous history of bronchitis. A greater mean duration of symptoms and a more frequent summer persistance were found in the more polluted zones. Differences in the frequency of coughing and expectoration and rhinitis persisting in the summer were found between the industrial and non-industrial zones. The quantity of suspended dust and the sulfur dioxide concentration among the various air pollution indices were well correlated with the data on the frequency of respiratory diseases. Investigations conducted on male groups confirmed the results relating to women, and showed a greater frequency of the cough-expectoration combination and recent respiratory disease among smokers. (Author summary modified)
APTIC-22317

### BEKESY AUDIOMETRY.

American Academy of Ophthalmology and Oto-
laryngology, Rochester, Minn., Course 321,
Instruction Section, 7p., 1969. 25 refs.
Frederick Harbert, and I. M. Young.
Identifiers: *Bekesy audiometry, *Hearing, Diagnosis, Thresholds.

The Bekesy audiometry method of testing hearing is described. A pure-tone oscillator with variable output parameters and a marking device to provide a permanent record of the tests is utilized. Variables include frequency, direction, repetitions, decay time, and masking noise. The device can determine thresholds and various pathological disorders, depending upon the subjects response to the different stimuli. The hearing level control is driven by an instantly reversible electric motor and is controlled by the subject. The effect of certain physiological symptoms on the results of the test are described.
APTIC-22324

### HEALTH AND THE URBAN ENVIRONMENT. AIR POLLUTION AND FAMILY ILLNESS: I. DESIGN FOR STUDY.

Arch Environ. Health, vol. 10: 357-363, Feb. 1965. 2 refs. (Presented at the Air Pollution Medical Research Conference, 7th Annual, Los Angeles, Calif., Feb. 10-11, 1964.)
James R. McCarroll, Eric J. Cassell, William Ingram, and Doris Wolter.
Identifiers: *Epidemiology, *Design criteria, *Area surveys, Respiratory diseases, Urban areas, Oxidants, Monitoring, Hydrocarbons, Carbon monoxide, Nitrogen dioxide (no2), Sulfur dioxide, Questionnaires.

To study the relationship between air pollution and respiratory illnesses, a longitudinal study of a significant group of city dwellers was undertaken with the simultaneous monitoring of the environment to which they were exposed. The goal was to follow the daily variations in health of a group of urban families of diverse backgrounds living in the same geographic area and to correlate these over a period of time with variations in the atmosphere to which they were exposed. The questionnaire was selected as the most suitable tool for this task, containing eight categories: general well-being; fever, headache, and eye symptoms; gastrointestinal symptoms; acute respiratory symptoms; miscellaneous; other health complaints; sources of health care; and indices of disability. One respondent in each family answered the questionnaire for the entire family each week. Young people without previous interview experience or a medical background conducted the interviews. To monitor the atmosphere, a weather and air pollution monitoring station was established in the center of the study area. Meteorological equipment included Aerovane, temperature differential recorder, hygrothermograph, pyrheliograph, and rain gauge. It was also equipped to measure sulfur dioxide, total hydrocarbons, carbon monoxide, total oxidants, total sulfation, nitrogen dioxide, and particulate density.
APTIC-22372

### EXPERIMENTAL STUDY OF THRESHOLD LIMIT OF NO2.

Arch. Environ. Health, vol. 10:455-466, March 1965. 34 refs. (Presented at the American Industrial Hygiene Association Annual Meeting, Washington, D. C., May 17, 1962.)
William D. Wagner, Burris R. Duncan, Paul G. Wright, and Herbert E. Stokinger.
Identifiers: *Toxic tolerances, *Nitrogen dioxide (no2), Laboratory animals, Bronchi, Alveoli, Oxygen consumption, Pulmonary function, Thresholds, Toxicity, Tumors, Acute, Chronic.

Six species of laboratory animals were exposed daily for periods up to 18 months to pure nitrogen dioxide at concentrations of 5 ppm, the present threshold limit, 1 ppm, and 25 ppm. Control groups were used throughout the studies. At no exposure level did changes in body weight, hematologic values, or biochemical indices deviate significantly from the control data. Studies with a spontaneous pulmonary tumor-susceptible strain of mice suggested a possible tumorigenic accelerating capacity for NO2. Pulmonary function test results on rabbits were equivalent to the controls, with the exception of the 25 ppm group, which indicated a slight and transitory elevation in mean oxygen consumption. Tolerance in aging rats and mice to acute lethal effects of NO2, after extended periods of development from exposure at 5 ppm and 25 ppm, was achieved. Detailed histologic evaluation of tissues of sacrificed animals presented no evidence that NO2 had any demonstrably morphologic effect on the production of pulmonary lesions or the susceptibility of animals to a pulmonary inflammatory process. These data present reliable evidence for the 5 ppm threshold limit value for NO2. (Author summary modified)
APTIC-22374

### SMOKE POLLUTION IN DWELLINGS OF INFANTS WITH BRONCHOPNEUMONIA.

Arch. Environ. Health, vol. 16:670-672, May 1968. 9 refs.
G. O. Sofoluwe.
Identifiers: *Bronchopneumonia, *Buildings, *Smokes, *Fuels, Infants, Wood, Africa, Coal, Fuel gases, Kerosene, Benzenes, Carbon monoxide, Nitrogen dioxide (no2), Sulfur dioxide, Socioeconomic factors.

Concentrations of the constituents of smoke are described, as generated from wood burners in Lagos, Nigeria, in homes of 98 infants admitted to the hospital with bronchiolitis and bronchopneumonia. Generally, most of the mothers (65) used firewood, and depending on their income group others used kerosene stove oil (39), coal (7), and gas (10). Average duration of exposure of the children to the smoke was estimated by a calculation of the time spent by mothers cooking to be 3.2 hr/day. There were no subjects from the high-income group who lived in the well layed-out residential areas of the city, and these diseases seem to be diseases of low-income groups and slum dwellers. Grades of smoke discoloration of the walls were determined in 53 cases. The children were exposed to average concentrations of 940.2 ppm of carbon monoxide; 8.6 ppm of nitrogen dioxide; 37.8 ppm of sulfur dioxide, and possibly 85.6 ppm of benzene. Attempts are being made to determine concentrations of other aromatic hydrocarbons by use of gas chromatography.
APTIC-22379

### CARBON MONOXIDE AND PERIPHERAL ARTERIAL DISEASE.

Scand. J. Clin. Lab. Invest. Suppl., no. 93:193-197, 1967 (*). 12 refs.
Poul Astrup.
Identifiers: *Cardiovascular diseases, *Carbon monoxide, Rabbits, Humans, Carboxyhemoglobin, Circulatory system, Lipids, Smoking, Europe.

The effect of carbon monoxide on the vascular system of animals was studied under various experimental conditions. Rabbits were kept for 6 weeks in atmospheric air containing 0.017% CO, leading to about 15% carboxyhemoglobin in the blood, and for another 2 weeks they were kept in about 0.035% CO. They were fed a cholesterol-containing diet during the entire period. In the experimental group, atheromatosis was far more developed macroscopically and microscopically than in the control group, and the average cholesterol content per 100 g wet weight of the aortic tissue was about 2.5 times higher. Also, 8 animals had myocardial necrosis and 7 had multiple small subendocardial hemorrhages, while in the control group only 1 had myocardial necrosis and no hemorrhages appeared. Serum cholesterol increased on an average somewhat more, about 20%, in the experimental group than in the control group, with great individual variations. A carbon monoxide induced oxygen lack in the tissues appears to influence the deposit of lipid in the arterial walls. These experimental findings and the findings of high concentrations of carboxyhemoglobin in many smokers with peripheral arterial diseases, suggest that chronic exposure to low concentrations of Co might be of importance for the development of human arteriosclerosis.
APTIC-22380

### THE LOW FREQUENCY AIR-BONE GAP IN SENSORINEURAL DEAFNESS.

Ann. Otol. Rhinol. Laryngol., 78 (1):107-112, Feb. 1969. 5 refs.
F. Harbert, and I. M. Young.
Identifiers: *Air-bone gap, *Deafness, Humans, Diseases and disorders.

When bone conduction thresholds are 10 db or lower than the air conduction thresholds, the air-bone gap is usually considered indicative of a conductive impairment. Many cases with severe sensorineural hearing loss have a significant air-bone gap in the lower frequencies (below 1000 Hz). This low frequency air-bone gap has been attributed to vibratory sensation or vestibular hearing. Bone conduction thresholds at the mastoid in severe sensorineural hearing loss are compared with vibratory sensation measurements made in a distant nonauditory area of the body not previously reported. Vibratory sensation is the most probable mechanism of pseudoauditory low frequency bone conduction. (Author abstract modified)
APTIC-22382

### EFFECT OF NITROUS OXIDE ON MYOCARDIAL CONTRACTILITY OF DOGS.

Can. Anaesth. Soc. J., 13 (4):361-367, July 1966. 11 refs. (Presented at the Canadian Anaesthetists' Society Meeting, Banff, Alberta, June 6-10, 1966.)
Richard O. Lundborg, James H. Milde, and Richard A. Theye.
Identifiers: *Heart, *Nitrous oxide (n2o), Dogs, Hemoglobin interactions, Blood vessels, Nervous system, Blood pressure, Pulse rate.

A study of the cardiovascular effects of the addition or removal of nitrous oxide during halothene anesthesia on dogs is discussed. Forty-three experiments were performed on eight dogs. Each set of observations included measurements of cardiac output; arterial, right arterial, left ventricular systolic, and left ventricular end-diastolic pressures; arterial blood pH, oxygen and carbon dioxide pressures; heart rate; arterial and mixed venous blood oxygen saturation; and hemoglobin concentration. Substitution of N2O for the nitrogen in the inspired mixture was associated with minor or insignificant changes in cardiac output, arterial blood pressure, oxygen uptake, and blood O2 and CO2 levels. Myocardial contractility, however, was reduced by N2O, and stroke peak and peak left ventricular pressure pulse were decreased in the presence of concurrent increased end-diastolic ventricular pressures. It is believed that the increased heart rate is caused by the analgesia provided by N2O which lessens vagal tone through a central nervous system mechanism. It is concluded that N2O is a myocardial depressant even when administered in clinically useful concentrations and in the absence of hypoxia.
APTIC-22386

### RELATIONSHIP BETWEEN AUTO EXHAUST COMPOSITION AND SMOG.

Preprint, California State Dept. of Public Health, Los Angeles, 17p., 1960. 3 refs. (Presented at the Conference on Methods in Air Pollution Studies, 4th, Los Angeles, Calif., Dec. 5-6, 1960.)
Paul P. Mader, and Marcel G. Eye.
Identifiers: *Eye irritation, *Gasolines, *Olefins, County governments, Regulations, Fuel standards, Engine exhausts, Smog, Fuel additives.

An automobile engine powered with six gasolines of different olefinic content ranging from 1-31% was driven on a typical test route; exhaust vapors representing all four cycles of engine operation were collected in an accumulator tank with the help of a proportionate sampling device. Analysis of the exhaust showed a high relationship between fuel and exhaust olefins. Eye irritation tests of the various exhausts in irradiated 50-l flasks, with hydrocarbon concentrations of 5, 3, and 1 ppm, were made on a panel of eight observers. Results of these and other studies demonstrated that the capability of auto exhausts to produce eye irritation, damage plants, and form aerosols in photoactivated processes is correlated with their contents of C4 and higher molecular weight olefins, and is not related to the quantities of ethylene, acetylene, and propylene in the exhausts. A second series of tests with different fuels and modified conditions for testing eye irritation in general confirmed the results of the first series, indicating a relationship between eye irritation potency and fuel bromine number. These studies are related to air pollution control regulations con-

trolling fuel composition in which non-reactive molecular species are substituted for high olefin content, to provide an interim measure for some alleviation of the irritating properties of smog.
APTIC-22439

### STUDIES OF INTERACTING ATMOSPHERIC VARIABLES AND EYE IRRITATION THRESHOLDS.

Intern. J. Air Water Pollution (London), vol. 7:257-280, 1963. 15 refs.
H. Buchberg, K. W. Wilson, M. H. Jones, and K. G. Lindh.
Identifiers: *Eye irritation, *Smog, Thresholds, Engine exhausts, Engine operating cycles, Simulation, Statistical analyses, Irradiation chambers, Acrolein, Formaldehydes, Hydrocarbons, Peroxyacyl nitrates, Nitrogen oxides, Photochemical reactions.

Air containing measured amounts of automobile exhaust was irradiated in a transparent air reaction chamber to simulate the formation of photochemical smog. The experiment was designed to establish statistical relationships between various exhaust components, certain atmospheric reaction products, solar irradiation, and the eye-irritating quality of the polluted air. One engine was operated under conditions simulating cruise (exhaust gas high in nitrogen oxides) and the other under conditions simulating deceleration (exhaust gas high in hydrocarbons). Correlation coefficients for eye-irritation and each of 28 physical variables and multiple correlation coefficients using all 28 physical variables and selected groups of variables were computed. The amount of hydrocarbon reacting or the amount of oxidized hydrocarbon formed is indicated to account for most of the variance in eye-irritation thresholds. Variation in nitrogen oxides concentration influences the rate of photochemical hydrocarbon oxidation but is not highly correlated with eye-irritation threshold. Formaldehyde concentrations are highly correlated with eye-irritation intensities, but the presence of other irritants such as peroxyacylnitrates or acrolein is also indicated. (Author abstract modified)
APTIC-22465

### RECENT GASES: THE LETHAL BOILER FLUE.

Med. Leg. J. (London), 36 (4):191-196, 1968.
Gavin Thurston.
Identifiers: *Carbon monoxide, *Asphyxiation, *Domestic heating, Humans, Adults, Mortality, Toxicity, London, Urban areas, Combustion gases, Boilers, Ventilation, Temperature (atmospheric).

In June 1968, during a hot spell with no wind in London, four people died of poisoning by carbon monoxide due to defective coke boiler flues compounded by defective building construction. A fifth man was found dead, also from carbon monoxide poisoning, but he had been dead for months. The four deaths were apparently the result of the temperature as high as 90 F, which was as hot as, or hotter than, the temperature inside the flues and reversed the flow of the flue gas. Through the defects of the flues, the gas re-entered the premises and eventually caused the deaths. A memorandum was issued by the Medical Officer of Health for the Royal Borough of Kensington and Chelsea concerning the boilers and boiler flues. He emphasized that especially for old Victorian tenements for multiple dwellings, some sort of permanent ventilation for boiler rooms are necessary, and boilers and other appliances in separate rooms need separate flues. Old flues should be repaired and relined in order to prevent leaks.
APTIC-22473

### MAINTENANCE OF NORMAL, METAPLASTIC AND PRENEOPLASTIC STATES OF ADULT HUMAN BRONCHIAL MUCOSA IN ORGAN CULTURE.

Preprint, California Univ., San Francisco, Cancer Research Inst., 25p., 1968. 17 refs.
Thomas V. O'Donnell, and T. Timothy Crocker.
Identifiers: *Tissue cultures, *Bronchi, *Epithelium, Pathological techniques, Biopsy, Membranes, Lungs, Trachea, Bronchial cancer, Lung cancer, Carcinogens.

The organ cultivation of adult human bronchial mucosa, obtained by biopsy or by dissection from portions of lungs surgically removed, is discussed. The histologic and cytologic characteristics of the mucosa are correlated with proliferative activity determined by autoradiography after brief incubation of tissues with tritiated thymidine. Basal hyperplasia was present in 14% of effective epithelial states found in cultured control explants, as compared to 3% of effective fresh mucosal epithelial states. Columnar epithelium was present in 24 of 29 epithelial states observed in fresh samples, and in 63 of 72 states found after cultivation for 5 to 15 days. Abnormal states were present in 17% of states recorded in fresh samples, and in 13% in cultured explants. It is believed that a significant proportion of viable epithelia can be sustained in a normal or pathologic state, with the exception of squamous metaplasia. The persistance of replicative, pleomorphic epithelial lesions in culture reinforces the significance of these lesions for human lung cancer by showing capacity for autonomous growth. Maintenance of differentiated epitheleum makes it possible to project tests of known or potential carcinogens and irritants expected to damage epithelia or to induce chronic bronchial disease or lung cancer in man.
APTIC-22487

### RELATIONSHIP OF AIR POLLUTION TO ALLERGIC DISEASES. (PROGRESS REPORT).

Minnesota Univ., Minneapolis, Univ. Health Service and Minnesota Univ., Minneapolis, School of Public Health, Proj. RG 6404, 13p., Feb. 1, 1960.
Donald W. Cowan, and Harold J. Paulus.
Identifiers: *Asthma, *Grain processing, Skin tests, Proteins, Allergies, Oxidants, Dusts, Pollens, Sampling methods, Dispersion, Winds, Humidity, Rain, Temperature (atmospheric), Nitrogen oxides, Sulfur dioxide.

A comprehensive survey was made of 288 medical records of asthmatics treated at the University of Minnesota Health Service during the past several years, and a correlation was found for those persons with a history of grain dust sensitivity and a subsequent positive skin test. Data have been collected on the total amounts and types of grain shipped into the area, the extent of grain handling operations which contribute to dust emissions, and the amount of grain utilized in special processing. An 'asthma diary' is kept by the patient who records the required information in considerable detail at the time of each attack. The patient also keeps an asthma calendar on which he circles the date of each attack. Laboratory methods for the separation and identification of protein materials in airborne dust samples are being developed. Dispersion of grain dust from the mill area is being studied, and instruments for continuous recording of wind direction and speed, temperature, relative humidity, and rainfall have been installed on the campus. Microscopic indentification of particulates in dust samples was made throughout the year with counts obtained on various pollens, mold spores, insect hairs, starch grains, and grain fragments. Sampling of sulfur dioxide, oxides of nitrogen, and total oxidant is being carried out routinely. Three permanent sampling stations were selected where gaseous and particulate samples are being collected to characterize the exposure agents.
APTIC-22513

### THEORY OF WORK OF THE IBK-1 AEROSOL CHAMBER FOR THE STUDY OF EXPERIMENTAL RESPIRATORY INFECTIONS--II. EVALUATION OF AEROSOL FROM CERTAIN PHYSICAL PARAMETERS.

Vop. Virusol., 6 (4):458-462, 1961. 6 refs.
Translated from Russian. Fort Detrick, Frederick, Md., p. 497-502, 1961. CFSTI, DDC: AD 683033
V. M. Bolotovskii.
Identifiers: *Respiratory functions, *Viruses, *Aerosols, Laboratory animals, Ussr, Exposure chambers.

From the respiratory volume of various animals, determinations were made of the amount of virus-containing material which they will take up on contact with a virus-containing aerosol in the IBK-1 aerosol chamber. The amount of virus-containing suspension in grams is equal to the concentration of virus per ml multiplied by the respiratory volume in ml per min multiplied by the body weight in g multiplied by the time of contact with the aerosol in min. Losses in the aerosol cloud due to settling out of the particles according to Stokes' law were determined; for the various types of coagulation, Stokes settling is the fundamental factor. (Author conclusions modified)
APTIC-22554

### THE DETERMINATION OF BLOOD AMMONIA BY DERIVATIVE SPECTROMETRY.

Preprint, Florida Univ., Gainesville, Dept. of Aerospace Engineering, Pittsburgh Univ., Pa., Medical Center, and Miller (J. Hillis) Health Center, Gainesville, Fla., 14p., 1960. 15 refs.
Robert N. Hager Jr., David R. Clarkson, and John Savory.
Identifiers: *Blood gas analysis, *Ultraviolet spectrometry, *Ammonia, Hematology, Diagnosis, Blood cells, Liver, Kidneys, Carbonates, Potassium compounds, Nitrogen, Pressure, Ph.

Total ammonia nitrogen can be directly measured in blood through the use of derivative spectrometry. De-proteinized blood supernatant is added to potassium carbonate in a closed quartz cell. The equilibrium pressure of ammonia gas over the fluid is measured by detecting the ultraviolet absorption spectrum of ammonia with a second derivative spectrometer. Undetectable interference effects are eliminated since a unique absorption spectral pattern exists for ammonia. Results of preliminary tests indicated a mean normal blood ammonia content of 1.13 micrograms/ml for fifteen subjects, and that supernatant can be stored at -4 C for up to 72 hours without a detectable change in ammonia content. (Author abstract)
APTIC-22561

### EPIDEMIOLOGICAL CONSIDERATIONS OF TYPES OF EXPOSURE TO BERYLLIUM.

Cincinnati Univ., Ohio, Kettering Lab., Proc. Workshop Beryllium, Cincinnati, Ohio 1961, p. 65-71. 7 refs. (Jan. 5-6.) CFSTI, DDC: AD 267130
Thomas F. Mancuso.
Identifiers: *Epidemiology, *Research methodologies, *Beryllium compounds, Health statistics, Mortality, Occupational health, Primary metallurgical processing.

An exploratory epidemiological study is underway to determine the long-term effects of exposure to beryllium on persons working in two beryllium plants between 1937 and 1942. The method operates by way of Social Security records through which the employee population of any covered industry can be established as a cohort for any year from 1937 to the present. Mortality patterns will be established from death claims to the Social Security Administration. Considerations involved in applying this approach to particular industrial hazards can be grouped into the following categories: types of processes and related types of exposure; dilution factors and populations at risk; latent periods; duration of exposure; comparative statistical data; and family morbidity studies. Collection of this data depends on the fullest cooperation of the industries, physicians, official agen-

cies, employees, and their families. However, in view of the fact that beryllium has produced cancer in laboratory animals, a thorough epidemiological study of beryllium is required.
APTIC-22573

### TOXIC CHARACTERISTICS OF BERYLLIUM (EXPERIMENTAL FINDINGS).

Cincinnati Univ., Ohio, Kettering Lab., Proc.
Workshop Beryllium, Cincinnati, Ohio, 1961, p.
59-64. 15 refs. (Jan. 5-6.) CFSTI, DDC: AD 267130
Arthur J. Vorwald, and Andrew L. Reeves.
Identifiers: *Toxicity, *Beryllium compounds, Laboratory animals, Nucleic acids, Lung clearance, Anemia, Lung cancer, Transport.

Preliminary experimental data indicate that beryllium is highly toxic, especially in its ionized (soluble) forms. Part of the toxicity may be related to the acidity of the solution and the associated chemical irritations. On contact with tissue fluids, beryllium forms colloidal orthophosphate and hydroxide, which may influence the rate of pulmonary elimination of beryllium and its transport to nonpulmonary areas. Among the acute toxic effects of beryllium is a definite rise in the lipid-phospholipid ratio, which coincides with the maximum transport rate of beryllium out of the lung. As a chronic effect, beryllium causes alterations in the concentration and subcellular distribution of nucleic acids, expecially RNA. This change is postulated to be related to the toxicity of beryllium, to the immunological response in the production of the inflammatory beryllium lesion, and to the development of neoplasia. The toxic effects of beryllium observed by other investigators include rickets and necrosis of the liver in rats, anemia in rabbits, and general inhibition of growth. Intravenous injection of beryllium into rabbits produces osteosarcoma; inhalation into the lungs of rats induces primary pulmonary cancer. Complex problems are posed by the toxicity of beryllium since its different forms, when administered in different ways, produce different results in different tissues of different species of animals. (Author conclusions modified)
APTIC-22574

### THE CHEMISTRY OF BERYLLIUM COMPOUNDS.

Cincinnati Univ., Ohio, Kettering Lab., Proc.
Workshop Beryllium, Cincinnati, Ohio, 1961, p.
11-18. 47 refs. (Jan. 5-6.) CFSTI, DDC: AD 267130
Lester D. Scheel.
Identifiers: *Enzymes, *Beryllium compounds, *Hydrolysis, Cell metabolism, Ionization, Ions, Water.

Experimental data on the chemistry of beryllium compounds and their biological action are discussed. Water reacts with the beryllium ion to form either a monovalent Be (OH) (+) or a divalent Be2 (OH) (++) complex ion. The importance of the hydrolytic mechanisms for ion formation from beryllium salts is that, since hydrogen ions are created by the mechanism, they provide a biological mechanism to force the ionization reaction to go to completion. The hydrogen ions are readily removed from the body via the kidney, thus insuring the completion of the hydrolytic reactions. Of 21 enzymes studied, only alkaline phosphatase and myosin proved to be severely effected by the presence of beryllium. When beryllium glycerophosphate substrate concentrations reached six micron M, there was an 80% reduction in the normal activity of alkaline phosphatase. This means that the cellular metabolism of a cell poisoned by beryllium must slow down proportionately due to the limitation of inorganic phosphate.
APTIC-22575

### AIR POLLUTION BY MOTOR CAR EXHAUST GASES.

(Zatrucie powietrza przez spaliny samochodowe).
Ochrona Pracy, 21 (5):14-17, May 1966. 16 refs.
Translated from Polish. Franklin Inst. Research
Labs., Philadelphia, Pa., Science Info. Services,
12p., Dec. 16, 1969.
Henryk Wozniczek.
Identifiers: *Diseases and disorders, *Automotive emissions, *Toxicity, Maximum allowable concentration, Digestive system, Eyes, Nervous system, Anemia, Respiratory diseases, Europe, Internal combustion engines, Vehicles, Aldehydes, Hydrocarbons, Ketones, Tetraethyl lead, Carbon monoxide, Nitrogen oxides, Sulfur dioxide.

Components from motor vehicle combustion gases are discussed in terms of concentrations emitted and the symptoms which they produce. Narcotic properties of saturated hydrocarbons increase with an increasing number of carbon atoms in the molecule, while all hydrocarbons mixed with air in suitable proportions form explosive mixtures. Hydrocarbon vapors above C5 do not require high concentrations, and a concentration of 1 mg/liter is sometimes sufficient to cause dangerous effects in the human organism in a period of a few minutes. Ethylene, propylene, butylene, hexylene, and heptylene induce almost the same disease symptoms as hydrocarbons of the paraffin series. A permissible concentration limit of 0.1 mg/liter is recommended for these unsaturated hydrocarbons of the ethylene series. Diolefins act on mucous membranes in the gaseous or vapor state. Unsaturated hydrocarbons of the acetylene series oxidize more readily than hydrocarbons of the paraffin and olefin series, and are able to very easily attract atoms, atom groups, and particles from other compounds to their molecules. Fatty acids and their anhydrides act destructively on tissues, while formaldehyde is already able to lead to chronic intoxication at a concentration of 0.02-0.07 mg/liter. Aldehydes induce diseases of the respiratory tract, liver and kidney diseases, and diseases of the eyes and skin. Pure ketones produce diseases of the respiratory tract, the eye protective system, and diabetes and anemia. The human organism can tolerate a maximum of 0.01% CO by volume on continuous action for 8 hours daily. Intoxication causes loss of consciousness, convulsions, breathlessness, and asphyxiation. Swelling of the lungs occurs in severe cases of intoxication from nitrogen oxides, while sulfur dioxide acts similarly as a powerful irritant, especially on the mucous membranes. Gasoline vapors induce diseases of the respiratory system, nervous system, and the protective system of the eyes. Toxicity of gasoline vapors increases with increasing CO content in the mixture, and mental disturbances are among the chief symptoms of acute tetraethyl lead intoxication.
APTIC-22579

### AIR IONS. (A SUMMARY OF THE BIOLOGICAL, MEDICAL, AND PSYCHOLOGICAL ASPECTS OF AIR IONIZATION AS PRESENTED AT THE INTERNATIONAL CONFERENCE ON IONIZATION OF THE AIR, FRANKLIN INSTITUTE, PHILADELPHIA, PA., OCT. 16-17, 1961).

Public Health Service, Washington, D. C., Div. of
Air Pollution, 7p., 1961.
Charles R. Sharp.
Identifiers: *Ions, *Electrostatic aerosol generators, *Inhalation therapy, Laboratory animals, Humans, Allergies, Asthma, Bronchitis.

The biological, medical, and psychological aspects of air ionization are summarized. Mention is made of the possible need for ion generators in heating, air conditioning, and air purifying systems whereby a balance of temperature, relative humidity, and ionization could raise the bodily comfort and increase production levels. When artificially produced atmospheric ions were breathed in through the mouth, they apparently had an effect on the human system as manifested by a change in the simple reaction time. Short exposure to negative ions produced some benefit in 46 patients suffering from asthma, bronchitis or nasal allergy. Students subjected to daily sessions of inhalation of highly ionized air of negative polarity showed a considerable improvement in the general tone, cheerfulness, energy, good sleep, and appetite. New born hamsters attained full weight more rapidly in a negative atmosphere, while some observations are also reported on excised tracheal strips and exposed tracheas of living rabbits, mice, rats, guinea pigs, and monkeys. Fabrics of polyvinyl chloride develop considerable amounts of negative static electricity, and appear to have a therapeutic effect on certain rheumatic and arthritic conditions. Indications for electro-aerosol therapy are listed. Statistical evaluation of the influence of atmospheric ions and experimental controls are also examined.
APTIC-22582

### ATMOSPHERIC AIR POLLUTION IN LITHUANIAN CITIES.

For primary bibliographic entry see Field 01.
APTIC-22591

### NEW STUDIES ON THE EFFECT OF SULFUR DIOXIDE AND OF SULFURIC ACID AEROSOL ON REFLEX ACTIVITY OF MAN.

In: Limits of Allowable Concentrations of
Atmospheric Pollutants. Book 5, V. A. Ryazanov
(ed.), p. 86-92. Translated from Russian. B. S.
Levine, March 1962. 2 refs.
K. A. Bushtueva.
Identifiers: *Sulfuric acid, *Sulfur dioxide, *Cerebral cortex, Humans, Nervous system, Thresholds, Ussr, Odors, Aerosols, Electrical measurement devices.

Data on the threshold reflex activity of simultaneously present sulfur dioxide and sulfuric acid aerosol were gathered by a direct continuous recording of the effect of inhalation of the gases on the cerebral cortex. Onset of electrical activity desynchronization, or alpha-rhythm suppression, was taken as the index of positive response. Sulfur dioxide brought about a well-defined desynchronization at 0.9 mg/cu m concentration. When combined with light, sulfur dioxide stimulated the development of conditioned reflexes. In such instances, desynchronization effect were even more pronounced. The maximum sulfur dioxide concentration eliciting conditioned reflexes was 0.6 mg/cu m. In other experiments, test subjects inhaled sulfur dioxide in subthreshold concentrations, with light the conditioned stimulator. After 19 associated applications, the reflex manifested itself even in the absence of sulfur dioxide, indicating that sulfur dioxide continues to stimulate reflex activity despite the extinction of the primary visible reaction. Incidental application of sulfuric aerosol in subthreshold concentrations elicited no electrical cerebral activity changes in the form of desynchronization. Where 0.63 mg/cu m, or threshold concentrations, were used, desynchronization lasting only 1-2 seconds was observed. However, when a 0.4 mg/cu m subthreshold concentration was used as a conditioned stimulator, with light the conditioned reflex reinforcing agent, a fully conditioned reflex eventually developed. This suggests that subthreshold odor perception concentrations of sulfuric acid aerosol can be used in establishing changes in cortical activity as recorded on an electroencephalogram.
APTIC-22594

### EFFECTS OF ELEVATED CARBOXYHEMOGLOBIN ON THE MYOCARDIUM.

Preprint, New York Academy of Sciences, New
York, 8p., 1970. (Presented at the Conference on
Biological Effects of Carbon Monoxide, New
York, Jan. 12-14, 1970.)
S. Ayres.
Identifiers: *Carboxyhemoglobin, *Circulatory system, Dogs, Humans, Hemoglobin interactions, Blood vessels, Heart, Blood pressure, Cell metabolism, Oxygen consumption, Oxygen diffusion, Ventilation (pulmonary), Carbon monoxide, Oxygen, Flow rates, Ph, Acute.

The physiologic effects of relatively small amounts of carboxyhemoglobin were studied by measuring the acute cardiorespiratory changes after inhalation of carbon monoxide in humans and dogs. Emphasis was placed on the cellular extraction of oxygen. Rapid changes in COHb were produced by inhaling 5% CO for 30 to 120 seconds. Blood CO content was measured by gas chromatography, and total ligand capacity obtained by measuring the CO and oxygen content of the subject's blood. An increase in COHb saturation of 7.98% was noted in the subjects who inhaled 5% CO. Cardiac output increased from 5.01 to 5.56 l/min; minute ventilation increased from 6.86 to 8.64 l/min; and arterial carbon dioxide tension fell from 40 to 38 mm Hg. The oxygen extraction ratio increased from 0.27 to 0.32, indicating oxygen extraction from the perfusing arterial blood. An increase of COHb saturation of 10% was observed in the subjects inhaling 0.1% CO. Mixed venous oxygen tension fell in both groups and was correlated with the increased COHb concentration. Arterial oxygen tension fell from 81 to 76 mm Hg after breathing 5% CO. The results were similar for the subjects breathing 0.1% CO. In the canine studies, an increased coronary blood flow, associated with the sudden COHb concentration elevation to 26.5%, was observed. Myocardial oxygen consumption fell from 6.1 to 4.9 ml/min. Lactate extraction decreased from 42% to 10%, suggesting myocardial hypoxemia. Theoretical aspects of systemic and myocardial oxygen exchange are reviewed.
APTIC-22608

### EFFECT OF CARCINOGENIC HYDROCARBONS ON SUCKLING RAT TRACHEA IN LIVING ANIMALS AND IN ORGAN CULTURES.

Perugia Univ., (Italy), Div. of Cancer Research,
Proc. Quadrennial Intern. Conf. Cancer, 3rd,
Perugia, Italy, 1965, p. 765-787. 7 refs. (June 24-29.)
T. Timothy Crocker, and B. I. Nielsen.
Identifiers: *Tracheal cancer, *Carcinogens, *Polynuclear compounds, Rats, Tissue cultures, Autopsy, Bronchi, Lungs, Trachea, Epithelium, Cell growth, Toxicity, Tumors, Benzopyrenes, Ultraviolet radiation.

The application of organ cultures for controlled induction and detailed study of cellular abnormalities produced in the respiratory epithelium of rats by carcinogenic hydrocarbons is considered in view of the differences and similarities between effects produced in vivo and in vitro. The epithelial lesions found in living animals after hydrocarbon injections were necrosis and sloughing off of all but basal cells. Equally severe, but less rapid, epithelial effects occurred in single, high dose exposure to cultured tracheas. No significant cartilage destruction occurred in vivo, but did occur in vitro when carcinogenic hydrocarbon concentrations were high. Basal hyperplasia and high columnar pseudostratified epithelium occurred in living animals as the last stage in recovery from 9,10-dimethyl-1,2-benzanthracene (DMBA). These states were also observed in organ cultures exposed to low concentrations of DMBA and then removed to normal media. The lack of effect of 1,2-benzpyrene as compared to 3,4-benzpyrene in vitro adds significance to the difference observed in vivo, and correlates with the carcinogenic states of these compounds. Explants exposed to these compounds were similarly affected, but when withdrawn from the hydrocarbons, 1,2-benzpyrene-treated explants returned to normal while 3,4-benzpyrene-treated explants did not. It is suggested that differences between hydrocarbons of different degrees of carcinogenicity may be sharper in short-term organ cultures than in short-term animal experiments.
APTIC-22610

### AIR POLLUTION AND RESPIRATORY DISEASES.

American Inst. of Medical Climatology,
Philadelphia, Pa., Proc. Symp. Air Pollution
Health, Philadelphia, Pa., 1966, p. 22-25. 1 ref.
(April 21.)
D. D. Harrell.
Identifiers: *Respiratory diseases, Humans, Epidemiology, Morbidity, Pulmonary function, Smoking, Lung cancer, Bronchitis, Emphysema, Non-urban areas, Urban areas.

The relationship between air pollution and respiratory diseases is discussed. It is known that death rates from chronic bronchitis, emphysema, and lung cancer are higher in the large metropolitan areas than in the rural districts. In general, the rate of these diseases is in direct proportion to the population of the area. Similarly, air pollution is greater in proportion to city size. Several criteria are suggested for determining the relationship between air pollution and respiratory diseases: statistical evidence that a disease exists; epidemiological evidence of the association between the disease and certain factors present; laboratory demonstration that these factors can produce a similar condition in experimental subjects; and, demonstration that protection from these factors will lessen the amount or severity of the disease. An epidemiological study was conducted on the relationship between pollution and chronic bronchitis. The results showed that London men over the age of 50 had severe respiratory symptoms, produced more sputum, and had lower lung function test results than men living in rural areas. It is suggested that chronic bronchitis may be a precursor to lung cancer, since it causes a premature aging of the tissues.
APTIC-22611

### CHRONIC NONSPECIFIC RESPIRATORY DISEASES IN THE CITY OF CRACOW. IV. STATISTICAL EVALUATION OF THE SAMPLING METHODS.

Przeglad Epidemiol., 23 (1-2):56-64, 1969. 8 refs.
Translated from Polish. Central Inst. for
Scientific, Technical and Economic Information,
Warsaw (Poland), Scientific Publications Foreign
Cooperation Center. CFSTI: TT 69-50001/1-2
Feliks Sawicki.
Identifiers: *Epidemiology, *Bronchitis, *Statistical analyses, Humans, Age, Health statistics, Europe, Urban areas, Sampling methods, Data analysis, Chronic, Questionnaires.

Statistical analysis of the material collected in a pilot study allowed calculation of the sampling error and estimation of the prevalence of chronic bronchitis symptoms in persons aged 18-69 in the Zwierzyniec district of Krakow. The sample size needed in the cross section study, which is planned to include the entire population of Krakow, was calculated. Analysis of those who were not interviewed showed that this group was not selected with regard to the studies characteristic, so that conclusions from the analysis of the examined group are applicable to the whole sample. Analysis of the design effect showed that the cluster sampling design applied in the cross section study of chronic bronchitis and in studies of the epidemiology of other diseases. (Author summary modified)
APTIC-22616

### OXYGEN TOXICITY AT NEAR-AMBIENT PRESSURES.

Proc. 2nd Ann. Conference Atmospheric
Contamination in Confined Spaces, p. 65-72. 7
refs. (May 4-5, 1966.) CFSTI, DDC: AD 646512
James D. MacEwen, and Charles C. Haun.
Identifiers: *Oxygen, *Toxicity, *Controlled atmospheres, Dogs, Mice, Primates, Rats, Mortality, Pressure.

Wistar strain albino rats showed a 15-20% mortality in a series of experiments conducted at reduced pressure in the Thomas Domes. It was suggested that the mortality was caused by the reduced pressure and pure oxygen environment. To determine if the observed mortality was a strain-specific effect, two groups of Wistar and Sprague-Dawley SPF strain rats were introduced into another chamber under the same environmental conditions. The same mortality was observed in the Wistar rats, but the Sprague-Dawley rats showed no ill effects from the exposure. In experiments at near atmospheric pressure in the presence of 100% oxygen, the older Wistar rats showed a greater susceptibility to the toxic effects of oxygen when compared with younger rats of the same strain. There was an overall reduction in the expected mortality of both strains when continuously exposed for 10 days. In a series of experiments which used different species, dogs and mice exhibited a similar pattern of oxygen toxicity response, and the albino rat was less susceptible than dogs, monkeys, or mice. It appears that when a recirculating system is used for exposure, some metabolic wastes or their oxidation products may accumulate and enhance the effect of oxygen toxicity.
APTIC-22672

### LIPIDS AND CANCER. A BIBLIOGRAPHY: 1947-1970.

Oak Ridge Associated Universities, Inc., Tenn.,
Medical Div., 118p., June 1970. 833 refs. CFSTI:
ORAU 111
Fred Snyder.
Identifiers: *Lipids, *Cancer, Chemical composition, Metabolism, Immunology, Tissue cultures.

This index of publications on lipids and related compounds in the field of cancer was compiled from Chemical Abstracts, vol. 41, 1947, through vol. 71, 1969, with some additional references. The articles are classified by subject of major emphasis in the following categories: reviews, lipid composition and related studies (ether-linked lipids, general, glycolipids, lipoproteins, malignolipin), biomembranes and organelles, metabolism, biological effects of lipids and related compounds, immunological studies, tissue cultures, cholesterol, and miscellaneous sterols. An author index is included.
APTIC-22725

### A STUDY OF REACTIONS IN LOS ANGELES SMOG. (FINAL REPORT).

For primary bibliographic entry see Field 08.
APTIC-22759

### NONSPECIFIC BIOLOGICAL ACTION OF AEROIONIZATION.

(Action biologique non specifique de
l'aeroionisation). Text in French. Biometeorol.
Proc. 3rd Int. Biometeorol. Congr., 1963, vol. 2,
part 2:1011-1015, 1967. 16 refs. (Sept. 1-7.)
M. C. Deleanu, and T. Frits.
Identifiers: *Inhalation therapy, *Ions, Europe, Ionization.

Experiments were undertaken to determine the influence of moderate concentrations of air ions (5000 to 20,000 ions/cu cm) on different biological processes. Negative air ion therapy had favorable results in cases of neurotic illness, gastric ulcer, bronchial asthma, and skin disease. Treatment also improved the performance of athletes. From the multiplicity of the effects, it is concluded that the biological action of aeroionization is nonspecific. (Author abstract modified)
APTIC-22856

### SOME ASPECTS OF THE DISPERSION OF POLLENS AND INDUSTRIAL CONTAMINANTS IN RELATION TO MICROMETEOROLOGY.

For primary bibliographic entry see Field 05.
APTIC-22857

### THE EFFECTS OF EXPOSURE TO LOW CONCENTRATIONS OF CARBON MONOXIDE AS REFLECTED BY TRACE METAL ALTERATIONS.

Oklahoma Univ., Oklahoma City, Thesis (Ph.D.),
Ann Arbor, Mich., Univ. Microfilms, Inc., 1968,
106p. 175 refs.
Stanley Charles Mazeleski.

Identifiers: *Carbon monoxide, *Rats, *Toxicity, *Metals, Chronic, Urinalysis, Heart, Kidneys, Nervous system, Lungs, Thresholds, Copper, Iron, Magnesium, Zinc, Cobalt compounds.

The effects of chronic carbon monoxide exposure on rats as reflected by trace metal alterations are investigated. The concentrations of zinc, copper, cobalt, iron, and magnesium are determined in the brain, heart, kidneys, lungs, spleen, liver, and urine. Carbon monoxide exposure has small effects on organ weight parameters which are reflected as a diminution of size, noted primarily in the lungs. Zinc appears to migrate out of the liver, and, to a lesser degree, out of the kidney, heart, and lungs. Relatively massive quantities of cobalt are lost from the liver. Each organ presents an individual pattern of trace metal content and changes due to chronic CO exposure. The level of CO exposure (50 ppm) used in this experiment is the currently accepted 'no effect' Threshold Limit Value; certain effects do occur, however, and these effects may be precursors to more clinically manifested effects. (Author summary modified)
APTIC-22864

### ASH AND SULFUR FROM THE VIEW OF HEALTH.

(Sot och svavel ur halsosynpunkt). Text in
Swedish. Konf. Energi och Miljo, Kungalu,
Sweden, 1969, no 6:1-3, 1969.
Einar Lindstrom.
Identifiers: *Sulfur dioxide, *Mortality, *Domestic heating, Air quality criteria, Fuel criteria, Monthly, Seasonal, Humans, Sweden, Urban areas, Stack gases, Air quality measurements.

An investigation concerning mortality in Stockholm due to air pollution did not give a negative result, despite high sulfur dioxide values during the winter months from 1965-1968. Sulfur dioxide concentrations between 10-15 pphm as a mean value/month were measured during Dec.-Feb. A decrease was observed after 1968 due to a sulfur limit of 1% in oil; the concentrations now are about 1/2 the former ones. An increase in district heating is now the only way to further decrease the $SO_2$ concentration, which is still over the Swedish recommendations.
APTIC-23360

### INTOXICATION FROM HYDROCARBONS. PART II. ANATOMICAL-PATHOLOGICAL CHANGES BY EXPERIMENTAL INTOXICATION FROM HEXANE.

(Intossicazioni da idrocarburi. Nota II. Rilievi
anatomo-patologici nella intossicazione
sperimentale da esano). Text in Italian. Folia Med.
(Naples), 51 (8):633-640, Aug. 1968. 7 refs.
G. Fichera, C. Spagna, and V. Timpanaro.
Identifiers: *Hexanes, *Toxicity, Guinea pigs, Circulatory system, Liver, Glands, Kidneys, Nervous system, Bronchi, Lungs, Alveoli, Sinuses, Italy.

Hexane ($CH_3$- $(CH_2)_4$-$CH_3$) is a hydrocarbon derived from oil, extensively used as a solvent in the paint industry and in the extraction of vegetable oils. Five mg/l is already in excess of the limits of tolerability. Workers exposed to hexane developed irritation in their joints and mucous membranes, insomnia, and a general state of irritability and changeability. Experiments were conducted on animals, making them inhale 150 mg/l hexane for 2 hours every day for thirty days and 30 mg/l for two hours every day for 60 days. Changes in the organs in the exposed animals were observed. One of the animals of the 30 days lot and two of the 60 days lot died during the test. The guinea pigs showed irritation of the nasal mucosa and joints. Some showed a loss of mobility in the hind legs. The internal organs have been so affected: Liver: hepatocystic vacuolation and swelling, tendency to fragmentization of the liver structure. Myocardial vein congestion. Lungs: congestion of the capillaries of the interalveolar spaces. Mucus in the bronchial tubes. Spleen: masses of pigment on the edge of the sinuses. Kidneys: congestion of the glomerular capillaries. Pancreas: hypertrophy in the islands of Langherans. Brains: vacuolization of the neurons. In general the esane poisoning caused diffuse congestive condition with degenerative plurivisceral parenchymal changes, more marked in the liver, brain and kidneys.
APTIC-23407

### PAINT INDUSTRY SMOG CHAMBER. II. SUMMARY OF WORK DONE.

National Paint, Varnish and Lacquer Assoc., Inc.,
Washington, D. C., Technical Div., Circ. 798, 2p.,
April 1970.
Francis Scofield.
Identifiers: *Eye irritation, *Smog, *Solvents, *Exposure chambers, Simulation, Testing facilities.

A smog chamber was constructed to evaluate specific organic solvents and their contribution to the smog problem and eye irritation. To date, 154 runs involving 45 materials and some mixtures have been made. Considerable effort was spent in studying techniques for analyzing the data obtained in an effort to obtain correlations that would allow prediction of eye irritation characteristics of solvents from structure or physical (or chemical) measurements. Solvents not previously evaluated for smog producing potential have been characterized, but attempts to correlate eye irritation with structure or chemical tests have, at best, been only partially successful. All the mixtures tested behaved in an additive manner as anticipated. There appears to be no positive evidence of synergism or inhibition that would require runs with many mixtures. It is hoped that the data obtained in the program will provide a basis for new regulations or possible revisions of existing regulations.
APTIC-23417

### BIOLOGICAL AND HYGIENIC SIGNIFICANCE OF AIR IONIZATION.

Biometeorol. Proc. 3rd Int. Biometeorol. Congr.,
1963, 2 (2): 1016-1024. 4 refs. (Sept. 1-7.)
A. A. Minkh.
Identifiers: *Bioclimatology, *Ionization, Inhalation therapy, Respiratory system, Ussr, Microorganisms, Dusts, Aerosol generators, Ions.

A study of atmospheric ionization at health resorts and comparison of the results with the patients' well-being and their clinical symptoms have made it possible to regard ionization as a new bioclimatological factor. An investigation of the physiological action of artificially ionized air confirms the biological significance of air ionization. Although physiological mechanisms involved in the action of air ionization have not as yet been precisely established, the main route of the ion action is considered to be the respiratory tract. The action of atmospheric ions through the skin is not excluded. The most complete study was that of the physiological action of negative ions widely used in therapeutic practice. Artificial air ionization may be used for the precipitation of dust and microorganisms in closed rooms. In an industrial establishment with powerful ion-formation sources, high ion concentrations may have an unfavorable effect on the organism. (Author abstract)
APTIC-23432

### THE EFFECT OF TOBACCO SMOKING ON THE HUMAN ORGANISM.

Wplyw palenia tytoniu na ustroj). Text in Polish.
Przeglad Lekar., no. 6: 549-552, 1968.
Wladyslaw Krol.
Identifiers: *Smoking, *Diseases and disorders, Mortality, Circulatory system, Digestive system, Enzymes, Nervous system, Respiratory system, Blood pressure, Cardiovascular diseases, Europe, Chemical composition, Hydrocyanic acid, Carbon monoxide, Hydrogen sulfide, Nicotines.

The composition of tobacco smoke and the mechanism of its effecting human organisms are considered. The effect of nicotine and its derivatives as well as that of carbon monoxide, hydrogen cyanide, and hydrogen sulfide on blood circulation and the central nervous, alimentary, respiratory and heart-vascular systems and their inhibitory effect on activity of enzymes are revealed and discussed. Physical and chemical properties of tobacco smoke are further analyzed. The connection between alkalinity or acidity of smoke and its toxic effect is explained as depending on the form in which the nicotine is present. In acidic tobacco (i.e., cigarettes), it exists in a form of salt with organic acids, while in the alkaline tobacco (cigars), it is free and as such cannot be inhaled by the organism. The concentration of compounds harmful to human health is highest in cigarette ends. The survey of research on effects of tobacco smoking on cardio-vascular systems is given. The statistics presented indicate a connection between tobacco smoking and cardiac diseases, heart attacks, blood pressure changes, and increased mortality in general.
APTIC-23459

### MEASUREMENT APPARATUS AND POSSIBILITIES OF INVESTIGATING BIOCLIMATOLOGIES.

(Appareils de mesures et possibilites
d'investigations bioclimatologiques). Text in
French. Biometeorol. Proc. 3rd Int. Biometeorol.
Congr., 1963, 2 (2):805-813. (Sept. 1-7.
J. Rivolier.
Identifiers: *Bioclimatology, France, Meteorological instruments, Electricity (atmospheric), Meteorology, Micrometeorology, Light radiation, Radioactive radiation.

The study of the correlations between meteorological and physiological-pathological phenomena is extremely complicated because of the difficulty of obtaining comparable parameters and the complexity of the apparatus used. Bioclimatological investigations make it possible to analyse the common meteorological factors, radiation, atmospheric electricity, radioactivity, air pollution, and to study microclimate. A synopsis of the major meteorological and seasonal events should also be made. Experimental investigations can be of different types, that is physiological, pathological, or based on dynamics and statistics of certain physiopathological phenomena. The polar environment is suitable for all types of biometeorological investigations. (Author abstract modified)
APTIC-23469

### CHRONIC NONSPECIFIC LUNG DISEASES: EPIDEMIOLOGICAL STUDY AT BRNO. (PRELIMINARY REPORT).

(Pneumopathies chroniques non specifiques:
enquete epidemiologique a Brno. (Rapport
preliminaire). Text in French. Bronches, 19
(2):185-199, 1969.
E. Jancik.
Identifiers: *Chronic, *Epidemiology, *Bronchitis, Ages, Males, Occupational health, Respiratory system, Respiratory functions, Smoking, Czechoslovakia.

All male inhabitants of one ward of the city of Brno between the ages of 40 and 64 were selected for study of chronic nonspecific lung disease in the fall of 1966. A total of 2736 persons were examined, representing 92% of the male population in this age group. In addition to filling out a questionnaire, the test subjects were examined to determine vital capacity, forced expiratory volume, and peak expiratory flow rate. Three chest x-ray pictures were taken, and the bronchial secretions of 100 subjects were subjected to bacteriological examinations. Results were statistically evaluated, and tables were constructed of frequently occurring symptoms, bronchitis in the medical history, use of tobacco, exposure to occupational risks (noxious gases, foundry work, coal mines, other types of mining, quarries, and textile

mills), meteorological conditions, habitat, and age bracket. Of the men examined, 20% were exposed to some type of noxious or irritating gases in their occupation. A remarkably high number of test subjects possessed the symptoms of chronic bronchitis; the figures were analogous to those obtained under similar conditions in Great Britain and the Netherlands. Observations seemed to support the hypothesis that other factors in addition to tobacco and exogonous influences--factors relating to individual peculiarities and constitutional weaknesses--play an important part in the incidence of chronic bronchitis.
APTIC-23476

### THE REPARATIVE CAPACITY OF ANIMAL LUNGS AFTER EXPOSURE TO VARIOUS SINGLE AND MULTIPLE DOSES OF NITRITE.

Am. Rev. Respirat. Disease, vol. 83:423-424, 1961.
Jerome Kleinerman, and George W. Wright.
Identifiers: *Pulmonary edema, *Lungs, *Nitrogen dioxide (no2), Guinea pigs, Rabbits, Rats, Pathological techniques, Exposure methods.

Rats, rabbits, and guinea pigs were exposed to controlled concentrations of nitrogen dioxide for two-hour periods. In single-dose experiments, animals were subjected to either a high dose, a moderate dose, or a low dose, whereas in multiple dose experiments animals were exposed on five successive days to low concentrations. Following exposure, animals were sacrificed at one, two, four, seven, fourteen, and twenty-one days; the lungs were fixed in inflation, prepared, and studied histologically. All rats and 33% of the rabbits died with severe pulmonary edema within 24 hours of the single high dose, but all animals survived the single moderate dose. Pulmonary edema was observed early, and inflammatory and epithelial regenerative changes were most severe in the region of the respiratory bronchiole. In the multiple low-dose exposures, edema and inflammation were less severe in an early stage, but peribronchial and perivascular chronic inflammation were more pronounced in the rat and guinea pig. Repair was almost complete by two weeks in the case of single-dose experiments and by seven days with the multiple low-dose exposures.
APTIC-23510

### RECENT DEVELOPMENTS IN ENVIRONMENTAL CANCER.

A.M.A. Arch. Pathol., 58 (4):360-399, Oct. 1954. 277 refs. and 58 (5):475-523, Nov. 1954. 650 refs.
W. C. Hueper.
Identifiers: *Epidemiology, *Cancer, Humans, Foods, Health statistics, Morbidity, Occupational health, Hormones, Smoking, Carcinogens.

The history of occupational cancer is reviewed, highlighting the tremendous increase in available data since 1925. Data is presented to substantiate the author's thesis that cancer is primarily environmental in its morbidity and demography, in contradiction to the belief popular in the early part of the century that cancer was principally hereditary. Environmental carcinogens, both organic and inorganic, are reviewed, and physical agents, principally radiation, are considered as to their affect on the incidence and demography of cancer. Evidence is presented that certain alkaloid extractives of tobacco may be an etiological factor in the development of cancer of the mouth. Similarly, evidence supporting dietary deficiencies as being related to uterine and liver cancer is considered. Latent periods, estimated to be on the order of 6-7 years, make specific causal relationships difficult to identify. Concern is expressed over the increasingly frequent and uncontrolled exposure to estrogens. Their use in fattening and tenderizing poultry is described, both in the recommended and in the practiced manner which differ to the detriment of the poultry-buying public. Exposure is also possible through the use of estrogen-containing cosmetics and dermatologic preparations for topical application. Prolonged use has, in some cases, resulted in endometrial glandular hyperplasia. Many common foods such as milk, eggs, lobster, liver, potatoes, yeast, honey, and sage contribute to a cumulative low-level exposure to estrogens.
APTIC-23525

### CHRONIC OXIDANT EXPOSURE AND EPIDEMIC INFLUENZA.

Preprint, National Air Pollution Control Administration, Durham, N. C., Div. of Health Effects Research and California Dept. of Public Health, Berkeley, General Epidemiology Section, 25p., 1970 (*). 27 refs.
M. E. Pearlman, J. F. Finklea, C. M. Shy, J. Van Bruggen, and J. Chin.
Identifiers: *Children, *Influenza, *Oxidants, Age, Males, Females, Absenteeism, Epidemiology, Hemoglobin interactions, Morbidity.

The effect of chronic oxidant air pollution upon epidemic A2/Hong Kong/68 influenza incidence and duration was studied retrospectively during 1968-1969 among 3500 elementary school children from five Southern California communities selected to represent a pollution exposure gradient. Information from school absenteeism, questionnaires, and hemagglutination inhibition (HI) titers revealed no statistically significant morbidity differences corresponding to the pollution dose gradient. Only 27.2% of the children remained entirely well; 37.4% reported nonspecific illness without fever; 13.9% had a febrile illness not clinically typical of influenza and 21.5% had febrile clinical influenza. Overall, 24.6% had diagnostically elevated convalescent HI titers, greater than or equal to 1:32. Although females reported more illness, the excess was not serologically confirmed. Second graders consistently reported more illness in all categories but exhibited lower HI titers, probably because they lacked the immunologic experience of older children. Subclinical influenza, seroconversion without illness, was observed in 10.3% of the population. The clinical to subclinical ratio ranged from 2.3 to 6.3, depending on the definition of illness. Influenza was associated with school absences averaging 3.3 days, and periods of restricted activity averaging 6.3 to 7.4 days. Other studies are suggested. (Author abstract)
APTIC-23528

### SULFIDE POISONING AND METHEMOGLOBINEMIA. (PROGRESS REPORT).

Dartmouth Coll., Hanover, N. H., School of Medicine, PHS Grant AP 00260, 35p., Nov. 1, 1969. 17 refs.
Roger P. Smith.
Identifiers: *Methemoglobinemia, *Hemoglobin interactions, *Sulfides, Hematology, Blood chemistry, Polarographic methods, Spectrophotometry, Hydrogen sulfide.

The protective and antidotal capability of chemically-induced methemoglobinemia in acute poisoning by hydrogen sulfide or soluble sulfide salts is regarded as experimentally established, and major attention is given to investigating the possible existence of a new chemically-induced species of hemoglobin. The ferrous hemoglobin product of methylene-blue stimulated methemoglobin reductase activity appears to have properties different from those of the product of diaphorase I activity, and is called Hemoglobin X. It seems to have an absorption spectra similar to oxyhemoglobin but a much lower apparent oxygen capacity, and shows a stability to oxygen completely inconsistent with it being deoxyhemoglobin. It is tentatively suggested that it is an oxyhemoglobin which reacts abnormally with ferricyanide in such a way that some of the heme oxygen is consumed, and that it is related to the generation of extra-heme sulfide binding sites by most common methemoglobin-generating chemicals. Experiments completed or underway are described in detail, as well as research on spectrophotometric, manometric, and polarographic techniques related to these studies and the mechanism by which common methemoglobin-generating chemicals effect oxidation of the heme iron.
APTIC-23533

### AN APPRAISAL OF RUMEX POLLEN AS AN AEROALLERGEN.

Preprint, Michigan Univ., Ann Arbor, Section of Allergy, 20p., 1969 (*). 13 refs.
William R. Solomon.
Identifiers: *Rumex pollen, *Allergies, Humans, Skin tests, Respiratory diseases, Pollens, Air quality measurements, Continuous monitoring, Pollen collectors.

The pollen of the sorrels and bocks were investigated as a possible exacerbating factor in allergic symptoms induced by such acknowledged seasonal offenders as late tree pollen, grass pollen, and spores of imperfect fungi, during the period of major Rumex deposition between May 25 and June 20. During 1965-67, atmospheric samples were taken continuously during four 2-hr intervals within each 24-hr period with a rooftop rotobar sampler; in addition, glycerin jelly-coated gravity slides were exposed in a standard Durham sampler nearby and, in 1965, a spore trap was used as well. Epidermal tests were performed with commercially obtained, laboratory-modified sheep sorrel pollen on 527 consecutive new allergy clinic patients whose clinical evaluation dictated immediate-type skin tests; nasal provocative tests were also performed using 1:500 Rumex pollen extract and 1:500 mixed grass pollen extract. The data suggest that airborne Rumex pollen may be present annually in significant concentrations and that its comparative prevalence has been understated previously by gravity slide surveys. Among the group of exposed atopic patients studied, a high percentage manifested skin and mucosal sensitivity to components of Rumex pollen extracts. It remains unclear whether Rumex pollen alone can produce pollinosis symptoms, but it seems likely that they contribute to various factors promoting seasonal respiratory disease.
APTIC-23539

### MODIFIERS OF CARCINOGENESIS.

Prog. Exp. Tumor Res., vol. 11:86-99, 1969. 19 refs.
F. Homburger, and A. Tregier.
Identifiers: *Carcinogens, *Operating variables, *Experimental methods, Mice, Age, Cancer, Lung cancer, Exposure methods, Pentaphenes.

Factors which modify carcinogenesis are reported for two experimental systems - chemical modifiers of subcutaneous carcinogenesis by benzo (rst)pentaphene in mice and biological and chemical modifiers of pulmonary carcinogenesis by intravenous injection in certain strains of mice, the significance of these results for carcinogen testing are discussed. Time, strain, and solution vehicle, including water, Ringer's solution, Tween 20, peanut oil, tricaprylin, human beta-lipoprotein, and mineral oil were the major modifiers investigated. It is concluded that in such studies it is not sufficient to control species, strain, sex, and age. Attention must also be paid to the vehicles used and the time schedule in the case of subcutaneous studies, and additionally to the genetics and age of the animals in studies using incidence of lung adenomas as an end point. In the case of testing for carcinogenic potency of such complex mixtures as tobacco smoke, air pollutants, fossil fuels and their combustion products, it is imperative to keep in mind that there exists in such products a mixture of tumor initiators, promoters, and inhibitors which are in delicate equilibrium and which may interact or be metabolized in vivo in different ways, depending on the biological systems into which they are introduced.
APTIC-23550

### A MODIFIED DIFFUSION METHOD FOR THE DETERMINATION OF URINARY FLUORIDE.

Am. Ind. Hyg. Assoc. J., 26 (5):461-464, Sept.-Oct. 1965. 7 refs.
A. G. Cumpston, and B. D. Dinman.
Identifiers: *Urinalysis, *Diffusion, *Fluorides, Occupational health, Spectrophotometry, Sodium compounds.

A modified diffusion method for the determination of urinary fluoride is described. Forty-eight samples, each with a volume of 0.5 ml, were taken from the same specimen of urine, and increasing quantities of sodium fluoride were added. Twenty-four distilled water blanks were also prepared. Silver perchlorate-perchloric acid solution was added to the urine samples and the distilled water blanks. Diffusion was commenced and allowed to continue for 20 hours at 50 C. After diffusion, measured amounts of sodium fluoride were added to the aqueous extracts of the filter papers from the sample blanks, and absorbances were read on the Beckman DU spectrophotometer, using 1-cm cells. The plot of the absorbance readings was linear for values between 1 and 6 micrograms of added fluoride. Since these represent recoveries from 0.5 ml of urine, they are equivalent to values of 2 to 12 micrograms/ml, a range that would fully meet the requirements of fluoride exposure screening in industry.
APTIC-23563

### THE ERYTHROCYTE ALA-DEHYDRASE ACTIVITY AS A DIAGNOSTIC TEST IN OCCUPATIONAL LEAD POISONING.

(L'attivita ala-deidratasica eritrocitaria quale test diagnoltico ned saturnisma professionale). Med. Lavoro (Milan), vol. 57:647-654, 1966. 13 refs.
Translated from Italian. Belov and Associates, Denver, Colo., 9p., July 16, 1970.
D. Bonsignore.
Identifiers: *Lead compounds, *Diagnosis, *Enzymes, *Metal poisoning, Humans, Occupational health, Blood cells, Italy, Colorimetry.

The effect of lead poisoning on amino-levulinic-dehydrase activity was studied by colorimetrically determining the porphobilinogen, which is formed by ALA-dehydrase activity, present in the erythrocyctes of 50 subjects with chronic or acute lead poisoning. In 19 patients, no enzyme activity could be identified; in the others, it was distinctly lowered. The results demonstrate that diagnosis of ALA-dehydrase acitivity is a valid test of lead poisoning.
APTIC-23582

### NEW DUST STANDARDS FOR BRITISH COAL MINES.

For primary bibliographic entry see Field 11.
APTIC-23587

### POSSIBILITIES OF CAUSAL PROPHYLAXIS AND THERAPY OF PNEUMOCONIOSIS.

Arch. Environ. Health, 21 (2):181-191, Aug. 1970. 24 refs.
Hans-Werner Schlipkoeter.
Identifiers: *Polyvinylpyridine-n-oxide (pvno), *Treatment and aids, *Pneumoconiosis, Rats, Occupational health, Lung clearance, Silicosis, Quartz, Germany, Pyridines.

Although the concentration of dust in mining areas in the ceramic and glass industries has been held low by technical methods of dust control, a large number of workers exposed to the dust have acquired pneumoconiosis over a period of time. In German coal mines, the average percentage of cases with changes in the lungs as first detected by x-ray films has risen from 17.5% in 1966 to 18.4% in 1967. Polyvinylpyridine-N-oxide, the inhibitory influence upon experimental silicosis of which was first described in May 1961, prevents the cytotoxic effect of quartz in animal and cell culture experiments. More important than this inhibitory effect is the influence of the protective substance on lung clearance and advanced silicosis. Because the macrophages are responsible for the purification of the lungs, it can be expected that the protection of these cells by the polymer cancels the effect of the quartz which reduces the lung clearance. Experiments with rats indicate a definite dependency between the amount of quartz retained and the amount of protective substance used. However, the improvement of elimination is the same, whether the animals inhaled PVNO aerosol five times weekly for 15 minutes or once a week for 60 minutes. A higher quartz concentration also requires a greater amount of PVNO.
APTIC-23597

### THE CONCENTRATION OF METHYLCHLOROFORM IN EXPIRED AIR OF MAN AFTER EXPOSURE.

(Mechirukurorohorumu bakurogo no kokinodo ni tsuite). Text in Japanese. Rodo Kagaku (J. Sci. Labour, Tokyo), 46 (9):535-543, Sept. 10, 1970. 14 refs.
Sumie Fukabori.
Identifiers: *Methylchloroform, *Expiration, *Diagnosis, Humans, Males, Females, Urinalysis, Respiratory functions, Japan, Gas chromatography, Flame ionization detector, Colorimetry, Measurement methods, Gas sampling, Exposure methods, Chloroform.

The validity of evaluating exposure to methylchloroform vapor by determining its concentration in expired air was investigated. Two men and two women were exposed to methylchloroform vapor two hours a day with the average concentrations of 195, 376, 558 and 832 ppm per day for four days. Expired air was analyzed by a gas-chromatograph with a hydrogen flame detector. The concentration of methylchloroform in the air in the exposure chamber was determined by gas-chromatography, colorimetry (alkali-pyridine-benzidine method) and Kitagawa's detection tubes. There was little difference in results from gas-chromatography and colorimetry, but the detection tubes gave values 5-35% different. The expired air samples were collected nine times over a five-hour period after each daily exposure. The samples collected and kept in vinylidene chloride bag showed after 24 hours about 95% of the initial methylchloroform concentration and over 80% after 72 hours. The methylchloroform concentrations in the expired air one hour after exposure were on the average proportional to the exposure concentrations. The urinary output of TCA increased daily to reach a maximum on the fourth of the fifth day, and its level was above normal even four days after the cessation of exposure. The results led to the conclusion that the methylchloroform concentration in the expired air can serve as an indicator of daily exposure to methylchloroform and the urinary output of TCA can also be indicative of the degree of repetitive exposures to methylchloroform.
APTIC-23605

### ON THE PENETRATION RATE OF GASEOUS MATTER OF INHALED GAS-AEROSOL MIXTURES IN SIMPLE RESPIRATORY MODEL.

(Ryujobutsu no kyozonga gasujo osenbutsu no kidonai shinnyu ni oyobosu eikyo ni tsuiteno mokeishiken). Text in Japanese. Rodo Kagaku (J. Sci. Labour, Tokyo), 46 (9):544-554, Sept. 10, 1970. 18 refs.
Kikuzi Kimura.
Identifiers: *Simulation, *Nitrogen dioxide (no2), *Sulfur dioxide, *Deposition, Respiratory system, Synergism, Japan, Aerosols, Dusts, Glass fabrics, Absorption, Humidity.

The synergism of gas and aerosol was investigated by means of a simple model of a respiratory tract consisting of a vinyl tube with the inside moistened and a wet tube with the inside moistened under a constant condition. The gases used were sulfur dioxide and nitrogen dioxide. For particulates, dusts in ordinary outdoor air as well as black smoke resulting from the combustion of benzene were used. The penetration rate of SO2 increased with an increase in the flow rate of air through the wet tube or a decrease in concentration. In both cases, the addition of particulates further increased the sulfur dioxide penetration rate. For nitrogen dioxide, the change in the concentration or the flow rate of air did not have any appreciable effect on the penetration rate; the presence of particulate matter also did not have any influence on the penetration rate. The aspiration of air through a glass fiber filter for a dustmeter showed that within an hour after aspiration, the sulfur dioxide in air had the penetration rate of about 100%, but after 20 hours, the rate declined appreciably. Together with the change in value observed due to change in humidity, the observed phenomena indicate that sulfur dioxide gas was absorbed by the sulfuric acid mist to form small particles, which were subsequently trapped by the glass fiber filter.
APTIC-23606

### FOUL VAPOURS: PART 1.

For primary bibliographic entry see Field 05.
APTIC-23613

### NATURAL LEAD-210 CONTENT OF MAN.

Science, vol. 132:1666-1667, Dec. 2, 1960. 10 refs.
John B. Hursh.
Identifiers: *Lead compounds, *Isotopes, *Humans, Adults, Bones, Radiation counters, Bismuth compounds.

The natural lead-210 content of ash samples from 18 cadavers has been measured, and an average in vivo content of 0.015 picocurie per gram of wet bone is estimated. At least two 10-g aliquots from the whole body ash of each cadaver were analyzed for polonium-210. This measurement, converted to disintegrations per unit time, is equivalent to the Pb-210 activity, since the attainment of secular radioactive equilibrium for the Pb-210 to bismuth-210 to Po-210 decay sequence depends on the 139-day half-life of Po-210, and since the material was ashed 8 years prior to the polonium measurement. The method of polonium analysis involves a nitric-perchloric acid digestion of the ash, plating out of the polonium on a silver foil, and counting in a low-background, gas-flow, proportional counter. As a basis for comparison, the contribution of Pb-210 to the radioactive dose from natural sources is about one-fifth that from internally deposited radium-226 and its daughters when the total body content of a standard man is 120 pc of Ra-226. (Author abstract modified)
APTIC-23630

### CIGARETTE SMOKING AND ACUTE NON-INFLUENZAL RESPIRATORY DISEASE IN COLLEGE MALES.

Preprint, National Air Pollution Control Administration, Durham, N. C., Div. of Health Effects Research and South Carolina Medical Univ., Charleston, Preventative Medicine Section, 15p., 1970 (*). 23 refs.
J. F. Finklea, Victor Hasselblad, S. H. Sandifer, D. I. Hammer, and G. R. Lowrimore.
Identifiers: *Males, *Smoking, *Respiratory diseases, Acute, Adults, Age, Epidemiology.

The relationship of cigarette smoking to acute respiratory diseases such as influenza was studied. Acute upper and lower non-influenzal respiratory illness, but not enteric or traumatic illness, was significantly more frequent among cigarette smokers than non-smokers. Outpatient and hospital acute upper respiratory incidence rates for heavy smokers (greater than one pack per day) were 1.3 times those of non-smokers. Acute lower respiratory disease rates for heavy smokers were twice those of non-smokers. In each case, both lighter cigarette smokers; and cigar, pipe and ex-smokers exhibited intermediate rates. An index of severity, the ratio of hospital incidence rates to outpatient rates, was similar for smokers and non-smokers in each illness category. Cigarette

smokers comprised 34.5% of the 1848 volunteers in this prospective study. (Author abstract modified)
APTIC-23642

### MODE OF FORMATION OF 3,4-BENZOPYRENE IN HUMAN ENVIRONMENT.

Nature (London), 187 (4738):663-665, Aug. 20, 1960. 51 refs.
G. M. Badger, R. W. L. Kimber, and T. M. Spotswood.
Identifiers: *Hydrocarbons, *Benzo (3-4)pyrene, *Reaction mechanisms, Carcinogens, Australia, Pyrolysis, Benzopyrenes.

The widespread occurrence of 3,4-benzopyrene in the human environment suggest that this hydrocarbon may be implicated in non-industrial as well as industrial cancers. Pyrolysis of substances (e.g., dicetyl and aliphatic tobacco hydrocarbons) giving benzopyrene may proceed by initial cracking to a C16 unit, which afterwards gives a C6-C4 unit. Two such units would then give the key intermediate. To test this hypothesis, possible intermediate compounds (butadiene, styrene, ethylbenzene, phenylbutadiene, n-butylbenzene, and tetralin) were pyrolyzed at 700 deg and the resulting tars analyzed. Of these compounds, n-butylbenzene with its C6-C4 structure gave the greated quantity of 3,4-benzopyrene. In each case, the observed products could be explained by secondary reactions involving initial or primary radicals. For example, phenyl-, butadienyl-, and phenylbutadienyl-radicals are important initial radicals in the pyrolysis of phenylbutadiene; and napthalene an important product. The presence of fluoranthene, phenanthrene, and 3,4-benzopyrene in this tar can then be accounted for by the attack of the radicals mentioned on napthalene, followed by cyclodehydrogenation. Another important route to 3,4-benzopyrene appears to be the reaction of a C4 unit (such as butadiene) with a pyrene intermediate. Tars having high yields of 3,4-benzopyrene also had high yields of pyrene.
APTIC-23667

### AROMATIC HYDROCARBONS. II. PRESENCE IN THE PARTICULATE PHASE OF GASOLINE-ENGINE EXHAUSTS AND THE CARCINOGENICITY OF EXHAUST EXTRACTS.

For primary bibliographic entry see Field 03.
APTIC-23669

### PUBLIC HEALTH ASPECTS OF AIR POLLUTION.

In: California Legislature Assembly Committee on Air and Water Pollution, Final Summary Report.
p. 107-111, 1951 (*). 11 refs.
Clarence A. Mills.
Identifiers: *Health impairment, *Smog, Air pollution episodes, Males, Lung cancer, Pneumonia, Tuberculosis, Coal.

Serious man-made air pollution began with the use of coal as a fuel and especially as a source of power to turn the wheels of the Industrial Revolution. A number of correlations have been made between an atmosphere polluted by coal smoke and pneumonia mortality. In 1930 fog-bound fumes from a zinc smelter and sulfuric acid plant in Belgium killed 60 persons and made hundreds ill. An almost identical tragedy occurred at Donora, Pa., in 1948. In a statistical survey of respiratory deaths in Cincinnati and Pittsburgh, death rates for pneumonia, tuberculosis, and lung cancer were found to be sharply and significantly higher in the dirtier industrial areas of these two cities than in the cleaner residential suburbs. Males are involved much more than females in these effects of pollution. The observation that death rates from buccal and respiratory tract cancers rise along with those from pneumonia and tuberculosis points strongly to a general irritation of the tract as the basic factor involved. Smog irritations of the eyes and throats of the previously well provide a good index of the damaging quality of the polluted atmosphere which cannot be tolerated by the sorely ill. The Los Angeles situation is mentioned, as well as the need for research with respect to pollution damage to community health.
APTIC-23670

### AIR POLLUTION CONTROL: HEALTH ASPECTS AND MICROTECHNIQUES.

For primary bibliographic entry see Field 03.
APTIC-23671

### THE VAPOR TOXICITY OF A COMPOSITE SOLVENT AND ITS PRINCIPAL COMPONENTS.

A.M.A. Arch. Ind. Health, vol. 12:623-627, Dec. 1955. 16 refs. (Presented at the American Industrial Hygiene Association, Annual Meeting, Buffalo, April 28, 1955.)
Charles W. La. Belle, and Heinrich Brieger.
Identifiers: *Synergism, *Toxicity, *Solvents, Acute, Chronic, Guinea pigs, Mice, Rats, Exposure methods, Ketones, Vapors.

An investigation was undertaken to determine thy inhalation toxicity of a mixed solvent and to compare it with that of its individual components. In the first phase of the experimental work, groups of six adult white mice of 20-25 gm body weight were placed in a 2-liter chamber and exposed continuously to saturated vapor until all six mice were dead. Acute vapor toxicity was tested by placing groups of eight adult male albino rats in a 30-liter chamber and exposing them to a fixed concentration of vapor for a period of four hours. Chronic vapor toxicity was studied by exposing rats and guinea pigs to the vapors of the mixture and of the principal component, respectively, for periods of 12 weeks, 5 days a week, 7 hours a day. With exposure to saturated vapor, survival times range from a mean of 23 minutes for 1,3-amylene oxide to a mean of 224 minutes for propylene formal. The survival time of mice exposed to the mixture is 59 minutes, close to the value found for the principal component, methylethylketone,. Results of the acute vapor toxicity tests were similar for the mixture, which again was found to be close to that of methylethylketone, but the order of toxicity was reversed from that obtained with saturated vapor. Extended exposure of rats and guinea pigs to the vapor of the solvent mixture and of methylethylketone revealed no significant differences during their lifetime and on anotomical examination. These findings place the composite solvent in the toxicologic category of its principal component, methylethylketone.
APTIC-23672

### SULFUR OXIDES AND OTHER SULFUR COMPOUNDS. A BIBLIOGRAPHY WITH ABSTRACTS.

Public Health Service, Washington, D. C., Div. of Air Pollution, PHS Pub. 1093, Bibliography Ser. 56, 383p., 1965. 1008 refs.
Anna Grossmann Cooper.
Identifiers: *Sulfur oxides, *Sulfur compounds, Laboratory animals, Humans, Plant damage, Epidemiology, Occupational health, Materials deterioration, Sources, Chemical composition, Sulfur oxides control, Photochemical reactions.

A selective, annotated bibliography is presented of material on sulfur oxides and other sulfur compounds published in books, journals, and reviews from 1893-1965. The bibliography is arranged under 13 subject headings, within which abstracts are arranged by first author or, if no author is given, by the first significant word in the title. To facilitate access to items of interest, several supplementary indexes are included. There is an alphabetical index of authors and a title index arranged alphabetically within each of the 13 subjects. Both indexes contain numbers referring to the corresponding number of the abstract. The geographic location index has two major divisions: U. S. and foreign. As with the other indexes, all entries include the corresponding number of the pertinent abstract. A list of journals and their abbreviations and a glossary of abbreviations complete the bibliography. The subject areas include the following: sources, emission composition, atmospheric reactions, nature of atmospheres, human epidemiology, experimental human exposure, industrial exposure, animal epidemiology, experimental animal exposure, plant epidemiology and experimental exposure of plants, materials damage and visibility reductions, and control devices.
APTIC-23684

### ANNOTATED BIBLIOGRAPHY. THE EFFECTS OF ATMOSPHERIC POLLUTION ON THE HEALTH OF MAN.

481p., 1957. 790 refs.
Personal Author Not Recorded.
Identifiers: *Epidemiology, Air pollution episodes, Air quality criteria, Laboratory animals, Humans, Morbidity, Mortality, Occupational health, Circulatory system, Respiratory system, Respiratory functions, Thresholds, Cancer, Eye irritation, Health impairment, Metal poisoning, Respiratory diseases, Non-urban areas, Urban areas, Smog, Smokes, Air quality measurements, Fog.

An annotated bibliography of articles concerned with the physiological effects of pollution of the general atmosphere is presented. Reports of major episodes, epidemiologic investigations, morbidity and mortality, and rural-urban studies are included. Surveys of the levels of atmospheric contaminants are given. Clinical reports on direct effects on human health, including occupational health, are given, and experiments dealing with animals, used in determining thresholds, are also given. A number of articles dealing with cardirespiratory efficiency and the testing of pulmonary function are listed. Studies involving meteorological parameters such as fog and smog are included.
APTIC-23685

### MEASUREMENT OF MUCOCILIARY FUNCTION IN MAN.

Am. Rev. Respirat. Disease, vol. 99:13-23, 1969. 10 refs.
Michael F. Quinlan, Salah D. Salman, David L. Swift, Henry N. Wagner Jr., and Donald F. Proctor.
Identifiers: *Cilia, *Nostrils, *Flow rates, Humans, Diagnosis, Smoking, Respiratory diseases, Cameras, Humidity, Temperature.

Nasal mucociliary flow was studied in 46 normal subjects and 7 subjects who had undergone laryngectomy with an Anger camera for external detection of a single, small tagged particle placed on the nasal mucosa. The average flow rate was 7 mm per min in the former group and 8 mm per min in the latter group. No significant difference in transit time was noted over the temperature range of 70-78 F. The mean transit rate for studies conducted in a relative humidity greater than 30% and a temperature range of 73 to 78 F was 9.0 mm per min, compared with a mean of 6.0 mm per min when the humidity was less than 30% and the temperature range was 70-78 F. There was no difference in transit rates between smokers and nonsmokers. The average transit rate in 10 subjects with signs but no symptoms related to the upper respiratory tract was 6 mm per min, but the degree of inflammation of the mucosa did not correlate with the transit time. Five subjects complained of symptoms related to the upper respiratory tract, but they had no signs on inspection. In 2 subjects there was no movement of labeled or unlabeled particles, while the remaining 3 subjects had transit rates of 10, 8, and 4 mm per min. Normal transit rates were preserved in several subjects with acute upper respiratory infections; in several subjects with marked septal deviation, transit rates on the obstructed side were lower.
APTIC-23688

### SOME BIOLOGICAL EFFECTS OF AIR IONIZATION.

American Inst. of Medical Climatology,
Philadelphia, Pa., Proc. Intern. Conf. Ionization
Air, Philadelphia, Pa., 1961, 1 (12): 24p. 35 refs.
John L. Worden.
Identifiers: *Inhalation therapy, *Ions, Hamsters, Rabbits, Blood cells, Cell growth, Health impairment.

An investigation was undertaken of the effects of air ions on animal growth, organ growth and organ activities, and recovery from shock and injury. Polonium-210 ion generators were used for all work except that done with mammalian cell cultures when a tritium generator was employed. Hamsters exposed to negative ionization showed an increase in blood pH, while those exposed to positive ionization showed a little and entirely insignificant decrease. In a preponderantly negative atmosphere, new-born litters of hamsters attained full weight more rapidly than their control counterparts, and still more rapidly than those in the positively ionized cubicle. As related to total body weight, the heart, adrenal, kidney, testis, seminal vesicle and epididymis were proportionately larger, the spleen and liver unaltered, and the testicular fat masses smaller in negatively ionized animals than in the controls. Regeneration of the experimentally severed femoral nerve was enhanced in hamsters living in a negatively charged atmosphere and unaltered in those under positive ionization. Negatively ionized rabbits recovered from shock at a much more rapid rate than did any of the others. Positively exposed cultures proliferated less rapidly than their controls.
APTIC-23703

### EFFECTS OF NITROGEN TRIFLUORIDE ON CARDIOVASCULAR SYSTEM OF RATS.

School of Aerospace Medicine, Brooks AFB.
Tex., Aerospace Medical Div., Proj. 7753, Task
7753 07, SAM-TR-70-8, 6p., Feb. 1970. 6 refs.
CFSTI, DDC: AD 705045
Lloyd L. Foster.
Identifiers: *Nitrogen trifluoride, *Circulatory system, Rats, Blood pressure, Pulse rate, Toxicity, Cardiovascular diseases, Fluorides, Oxygen.

The specific toxicologic action of nitrogen trifluoride, a potential rocket propellant on the cardiovascular system was studied by exposing rats for one minute to tracheal inhalation of the gas. These rats had a definite decrease in diastolic pressure, systolic pressure, and heart rate. Similarly, rats that prebreathed oxygen for 5 minutes before exposure had the same changes in the cardiovascular system as those breathing only NF3. However, animals which inhaled oxygen for 5 minutes immediately after exposure to NF3 showed a temporary increase in diastolic pressure, systolic pressure, and heart rate. It is concluded that NF3 significantly affects the blood pressure and heart rate, and that oxygen alters some of its effects. These effects of NF3 could possibly be attributed to the formation of methemoglobin and myocardial degeneration. Studies by other investigators suggest that contact with NF3 may not only cause anoxemia and damage to the lungs, but harm to the erythrocytes as well. (Author abstract modified)
APTIC-23711

### THE ROLE OF THE VETERINARIAN IN AIR POLLUTION RESEARCH.

Preprint, National Air Pollution Control
Administration, Raleigh, N. C., llp., 1970. 7 refs.
Ronald E. Engel, and Jerry F. Stara.
Identifiers: *Research programs, *Veterinary medicine, Laboratory animals, Toxicity, Engine exhausts, Arsenic compounds, Hydrocarbons, Cadmium compounds, Lead compounds, Nitrogen dioxide (no2), Ozone.

Meaningful environmental research requires input from the integration of three scientific approaches: (1) laboratory animal toxicological studies; (2) laboratory clinical investigations of human subjects; and (3) epidemiological studies under naturally occuring conditions. Animal toxicology is needed to identify prime effects of pollutants by conducting controlled experimental exposures that block out the environmental variables normally existing under field conditions. Veterinary toxicologists, primarily those interested in all animals, are playing an important part in air pollution research and in interpreting animal experiments that are essential to establish the margin of safety for air quality standards. In the National Air Pollution Control Administration alone, veterinarians design and execute studies, the results of which are used for air quality criteria documents. One such study is an investigation of the chronic effects on beagles exposed to irradiated automobile exhaust. Other studies of environmental toxicity performed by government veterinarians include the effects of nitrogen dioxide on minimum responses; carcinogenicity of hydrocarbons; effects of ozone on the respiratory tract; effects of long-term exposure to cadmium, lead, and arsenic; and determinations of effects from inhalation of less common pollutants.
APTIC-23715

### TOXICITY OF THE OXIDES OF NITROGEN. III. EFFECT OF CHRONIC EXPOSURE TO LOW CONCENTRATIONS OF VAPORS FROM RED FUMING NITRIC ACID.

Arch. Ind. Hyg., Occupational Med., vol. 10:423-425, 1954. 5 refs.
Edward Le B. Gray, Stanley B. Goldberg, and
Francis M. Patton.
Identifiers: *Maximum allowable concentration, *Nitric acid, *Nitrogen oxides, Chronic, Guinea pigs, Mice, Rats, Treatment and aids, Lungs, Toxicity, Vapors.

In contrast to animals exposed for four hours a day, five days a week for six weeks to 9-14 ppm nitrogen dioxide, rats, mice, and guinea pigs exposed for four hours daily, five days a week for six months to 4 ppm vapors of red fuming nitric acid exhibited no toxic effects. In fact, the lower concentration of NO2 produced a significant prophylactic effect, since the degree of pulmonary congestion was less in the exposed animals than in control animals. The results lead to the conclusion that the maximum allowable concentration of nitrogen oxides should be set at 5 ppm.
APTIC-23738

### REPORT OF THE SWISS LEADED GASOLINE COMMISSION TO THE FEDERAL COUNCIL ON ITS ACTIVITIES DURING THE PERIOD 1947-1960.

(Bericht der Eidgenvessische bleibenzin-
kommission an den bundesrat ueber ihre taetigkeit
im zeitraum 1957-1960). Mitt. Gebiete Lebensm.
Hyg. (Bern), 52 (3):135-244, 1961. 17 refs.
Translated from German by Irene R. Campbell,
92p., June 1962.
Personal Author Not Recorded.
Identifiers: *Metal poisoning, *Engine exhausts, *Tetraethyl lead, Humans, Blood gas analysis, Ingestion, Retention, Toxicity, Toxic tolerances, Europe, Urban areas, Aerosols, Gasolines, Automobiles, Particle size, Automotive emission control, Ventilation.

Switzerland allowed the use of tetraethyl lead in gasoline as of April, 1947. A special commission was appointed at that time to follow the effects of this compound on public health. Preliminary investigations indicate that the quantity of lead in exhaust emissions varies according to speed. The size of the lead particles is so small that they behave like a gas. City dwellers inhale daily 20-30 micrograms of lead. Medical examinations of persons exposed to varying amounts of lead for prolonged periods of time are reported. The concentrations of lead in food products and water are determined. Methods to eliminate the hazards of lead include removing it from gasoline, removing the lead compounds from the exhaust gases, better ventilation of garages, and traffic regulation. (Author summary modified)
APTIC-23741

### EFFECT OF ATMOSPHERIC FLUORIDES ON MAN. (FINAL REPORT).

Utah State Univ., Logan, Utah Valley Hospital,
Provo, Utah State Hospital Provo, NIH, Grants S-83, S-83 (C1), and S-83 (C2), 71p., 1961 (*). 23 refs.
R. A. Call, D. A. Greenwood, and J. L. Shupe.
Identifiers: *Humans, *Fluorosis, *Fluorides, Bones, Tissues, Ingestion, Utah, Non-urban areas, Industrial areas, Particulates, Air quality measurements, Meteorology, Calcium compounds, Annual.

A report is presented which represents findings from studies designed to obtain information relating to the concentration of fluorides and total particulate matter in the atmosphere under known meteorological conditions in selected industrial and non-industrial areas in Utah, and to determine whether man, living in these areas, has been affected by the fluorides. Average yearly values for fluoride in impinger air samples are reported, and total particulate matter values are also given. Of the 127 human cases studied, 90 came from geographic areas known to have had elevated fluoride levels in the atmosphere and forage. Long-term ingestion of the latter produced changes characteristic of fluorosis in some animals. Analyses for fluoride, calcium, phosphorus, ash, and dry matter were made on various parts of the body. The studies indicate that the levels of fluoride to which Utah residents in these areas had been exposed are not responsible for gross or histologic changes in soft tissue or bone. Chemical and meteorological studies relating to the concentration of fluorides in the atmosphere are described. The medical studies were done on patients ranging in age from infant to 88 years old; their residence in the industrial areas ranged from 0 to 83 years. (Author summary modified)
APTIC-23763

### EPIDEMIOLOGICAL BASES FOR POSSIBLE AIR QUALITY CRITERIA FOR LEAD.

Preprint, Air Pollution Control Association, New
York City, 26p., 1969. 23 refs. (Presented at the
Air Pollution Control Association Symposium on
Toxicological and Epidemiological Bases for Air
Quality Criteria, June 24-25, 1969, Paper 69-146B.)
John R. Goldsmith.
Identifiers: *Air quality criteria, *Epidemiology, *Lead compounds, Humans, Blood chemistry, Urinalysis, Bones, Liver, Kidneys, Amino acids, Respiratory system, Ingestion, Respiratory functions, Toxicity, Absorption.

For most individuals, the diet is the major source of lead exposure. However, amounts of lead absorbed by the body via the oral and the respiratory routes may be similar in magnitude, even though the total amount ingested with food and water is usually several times the total inspired with air. Inorganic lead in sufficient amounts is implicated as a causative agent in decreased hemoglobin synthesis, liver and kidney damage, mental retardation in children, and abnormalities of fertility and pregnancy. There is evidence that exposure to moderately low lead levels may produce abnormalities in the synthesis of porphyrines, particularly by the inhibition of delta-aminolevulinic acid (d-ALA) dehydrase. This inhibition leads to increased blood and urine levels of d-ALA, and air quality criteria should include a criterion based on d-ALA excretion, if it can be shown to be related to community air pollution exposure. Recent epidemiologic data show that there is not a balance between lead absorption and excretion in Americans, lead concentrations increase in liver, spleen, pancreas, kidney, and lung up to the fifth decade and in the bone up to the fourth decade. Other studies imply that the total lead burden of the body is, in part, a function of respiratory exposure in areas of high motor pollution. It is recommended that air quality criteria proposed by the World Health Organization be amended to refer to concentrations and exposure times which result in significantly increased storage in the body of

potentially toxic materials, significant alteration of an essential metabolic process (such as porphyrin metabolism), and significant alteration in hematopoesis.
APTIC-23768

### A STUDY IN TRACE ELEMENT POLLUTION OF AIR IN 77 MIDWESTERN CITIES.

Preprint, Missouri Univ., Columbia, 21p., 1970. 14 refs. (Presented at the Conference on Trace Substances in Environmental Health, 4th Annual, Columbia, Mo., June 23-24, 1970.)
William F. Hunt Jr., Cecil Pinkerton, Owen McNulty, and John Creason.
Identifiers: *Cardiovascular diseases, *Urban areas, *Dust fall, Males, Mortality, Commercial areas, Industrial areas, Residential areas, Spectrophotometry, Trace analysis, Statistical analyses, Rain, Temperature (atmospheric), Cadmium compounds, Lead compounds, Zinc compounds.

A study is reported to examine a possible relationship between cadmium, lead, and zinc air pollution and cardiovascular disease by examining the metal fallout in the residential, commercial, and industrial areas of each of 77 midwestern U. S. cities chosen from standard metropolitan statistical areas. Monthly rainfall and maximum and minimum temperatures were obtained from the weather station nearest each dust fall sampling site. The dried residues of dust fall samples were analyzed for the three metals by atomic absorption spectrophotometry. Annual death rates for white males from cardiovascular diseases were calculated, and milk samples were analyzed for cadmium and lead. Statistical analysis did not reveal any significant relationship between cadmium fallout and cardiovascular death rates in the cities studied, despite earlier work suggesting such a relationship, nor was any association found when cadmium in milk was used as an indicator of cadmium fallout on croplands or in rural areas. A significant association was found between cardiovascular death rates and lead fallout in residential areas and with dust fall, and maximum and minimum temperatures. The association was found only for minimum temperature in the commercial and industrial areas. Evidence suggests that the relationship may reflect some factor or urbanization not examined and deserving of further study, despite the absence of any clinical or physiological evidence.
APTIC-23801

### OXIDANTS AND LUNG BIOCHEMISTRY: A BRIEF REVIEW.

Preprint, 22p., 1970. 47 refs. (Presented at the Hanford Biology Symposium, 10th Annual, Richland, June 2-5, 1970.)
F. Gordon Hueter, and Martin Fritzhand.
Identifiers: *Enzymes, *Oxidants, Chronic, Proteins, Lungs, Respiratory functions, Eye irritation, Emphysema, Nitrogen dioxide (no2), Ozone, Photochemical reactions.

A brief review of the literature relative to the biochemical effects of oxidant air pollutants on mammalian systems is presented; specific oxidants discussed are ozone, nitrogen dioxide, and the photochemical oxidant mixture. Continuous exposure to low concentrations of nitrogen dioxide appears to result in pathological alterations in the lung consistent with the histological and physiological diagnosis of emphysema. The literature concerning the biochemical effects of NO2 is concerned largely with the enzymatic alterations following exposure to that gas. Balchum and Buckley determined the manner in which the lactic dehydrogenase and aldolase activity levels changed during the course of chronic exposure to NO2. Alterations in isoenzyme activity suggest that NO2 favors conditions which inhibit aerobic and stimulate anaerobic oxidation in lung tissue. The possibility that NO2 alters lung protein leads to another area of discussion, and it is conceivable that some of the effects of NO2 are the direct result of its interaction with lipids responsible for cell membrane integrity. Ozone has been shown to lower resistance to respiratory bacterial infection, weaken lung structure, reduce pulmonary function, and disrupt cellular biochemistry. It has also been implicated as an accelerator for the aging process, as well as a radiomimetic agent. A decrease in human tear lysozyme has been observed in subjects experiencing eye irritation from photochemical smog. A total research approach for determining the health effects of air pollution is presented for consideration. (Author abstract modified)
APTIC-23875

### DOES AUTOMOBILE EXHAUST CAUSE HEADACHES*

(Kopfschmerzen durch auto-abgase*). Z. Praeventivmed., vol. 14:303-304, Sept.-Oct. 1969. 4 refs. Translated from German. Belov and Associates, Denver, Colo., 4p., Sept. 3, 1970.
W. Blumer.
Identifiers: *Headache, *Automotive emissions, Adults, Antidotes, Urinalysis, Germany, Streets, Residential areas, Hydrocarbons, Lead compounds, Tetraethyl lead, Carbon monoxide, Nitric oxide (no).

Adult inhabitants of a residential area without through traffic were compared with all people living right next to the heavily frequented main street of the same place. The cases concerned include all patients complaining about constant headaches during the past ten years, when no organic cause could be detected by means of general practice. In the houses immediately adjacent to the main street, percentage wise three times as many patients with headaches lived there than in the outside area. Observing these patients for many years, a short change of residence made the headache disappear. One hundred and twelve patients received twice weekly for four to five weeks an intravenous injection of a mixture of calcium-dinitrate-EDTA (20 mg per kilogram body weight), vitamin C (200 mg), and vitamin B1 (200 mg). This small dosage immediately cured 71% of the patients, distinctly improved 19%, and was unsuccessful with only 10%. In order to prove that this treatment actually causes an increased secretion of lead, a lead analysis of the urine was made for five patients. All cases showed an increase of lead secretion with the exception of one female patient. The people living close to traffic inhale at least four more kinds of exhaust gases (carbon monoxide, hydrocarbon, nitric oxides, tetraethyl lead), which cause headaches as an early symptom themselves and which simultaneously reinforce the toxicity of lead.
APTIC-23876

### ON INDUSTRIAL LEAD POISONING-A STATISTICAL SURVEY.

(Zur Bleierkrankung in der gewerblichen Wirtschaft - ein statistischer Ueberblick). Text in German. Staub, Reinhaltung Luft, 30 (8): 322-323, Aug. 1970.
Heinz Neubert.
Identifiers: *Occupational health, *Metal poisoning, *Lead compounds, Humans, Health statistics, Germany, Industrial emission sources.

The number of reported cases of lead poisoning in industry decreased by 48.2% in 1968 as compared with the cases reported in 1950. During the same period, the number of cases in which compensations were granted for the first time was reduced from 93 to 16. These compensations in the reported cases decreased from 9.5% (1950) to 3.1% (1968). From 1965 to 1968, the conditions varied every year for different branches of industry.
APTIC-23887

### HYGIENIC ASSESSMENT OF VEGETABLE DUST IN CELLULOSE CARDBOARD INDUSTRY.

(Gigienicheskaya otsenka rastitelynoy pyli tsellyulozno-kartonnogo proizvodstva). Text in Russian. Gigiena i Sanit., vol. 6:26-31, 1970. 9 ref
L. Kh. Tsyganovskaya.
Identifiers: *Plants (botany), *Dusts, *Paper manufacturing, Humans, Occupational health, Membranes, Respiratory system, Skin, Breathing, Allergies, Ussr.

A study of the sanitary hygienic labor conditions prevailing at the time of the cutting of reeds in the cellulose-cardboard industry showed that the main noxious effect is caused by organic dust of vegetable origin. Examination of workers revealed a high incidence of lesions in the mucous membranes of the upper respiratory tracts with prevalence of subatrophic forms, disturbances of external respiration, and development of positive allergic skin reactions under the action of extracts of cardboard and particularly reed dust. The allergenic properties of reed and cardboard dust were confirmed experimentally. (Author abstract modified)
APTIC-23893

### THE FILTERING CHARACTERISTICS OF SOLID PARTICLES IN HUMAN RESPIRATION.

(Zur Abscheidecharakteristik von festen Teilchen im menschlichen Atemapparat). Text in German. Staub, Reinhaltung Luft, 30 (7):286-292, July 1970. 26 refs.
Heinz Drasche, and Roman Reiter.
Identifiers: *Breathing, *Deposition, *Dusts, Humans, Retention, Respiratory system, Nostrils, Germany, Particle size.

Under normal working conditions with dust concentrations between 250 and 1800 mg/cu m, the total dust inhaled and exhaled is sampled in 13 human subjects. The weight of the dust sample is evaluated, followed by a particle size analysis and a count of the particles with a Coulter counter. The particle-selecting power of the human respiratory tract is described. The filtrative action of the noise, as far as respirable dust is concerned, is not substantially greater than oral breathing. Comparing the particle-size distribution of inhaled and exhaled dust, the respiratory frequency is of primary importance, followed by the type of inhalation, nasal or oral. (Author abstract modified)
APTIC-23894

### SUBSTANTIATION OF THE MAXIMAL PERMISSIBLE CONCENTRATIONS OF AMMONIUM DIURANATE IN THE AIR OF INDUSTRIAL PREMISES.

For primary bibliographic entry see Field 11.
APTIC-23900

### PULMONARY SURFACTANT AND EVOLUTION OF THE LUNGS.

Science, 169 (3945) 603-604, Aug. 7, 1970. 21 refs.
John A. Clements, Jean Nellenbogen, and Harold J. Trahan.
Identifiers: *Lipids, *Alveoli, *Surfactants, Animals, Laboratory animals, Humans, Lungs.

Experiments were performed to determine whether the quantity of surfactant present in various lungs is appropriate to their respiratory surface area and whether their lipid composition reflects such a relationship. Human lung tissue was studied as well as lungs from adult animals (guinea pig, rabbit, mouse, dog, sea lion, rat, chicken, turtle, frog, and cow). The amount of surfactant, estimated by quantitative spreading as a surface film, correlated well with alveolar surface area and with the amount of saturated, mainly dipalmitoyl phosphatidylcholine in the lung parenchyma. The quantities of other phospholipids did not correlate well with alveolar surface area. Substances subserving cellular needs may be related principally to the mass of the pulmonary tissue. If such a conclusion is valid, it pro-

vides a simple example of the unit of biochemical organization in the biological world.
APTIC-23914

### LEAD DOSAGE AND THE ROLE OF THE INTRANUCLEAR INCLUSION BODY. AN EXPERIMENTAL STUDY.

Arch. Environ. Health, 20 (6):705-711, June 1970. 21 refs.
Robert A. Goyer, Daniel L. Leonard, John F. Moore, Bonnie Rhyne, and Martin R. Krigman.
Identifiers: *Kidneys, *Metal poisoning, *Lead compounds, Rats, Pathological techniques, Bioassay, Urinalysis, Cells, Ingestion, Anemia.

Biological parameters known to be affected in lead poisoning were measured in rats following ingestion of graded dosages of lead. Six groups of rats were given tap water containing the following quantities of lead in the form of lead acetate: 0.08, 0.20, 0.40 1.20, 2.00, and 10.0 mg of lead per milliliter. The animals were weighed weekly and 24-hour urine collections were made prior to killing at 10 weeks of age. Both kidneys were quickly excised and analyzed. Another group of rats received pulverized 1% lead as lead acetate mixed with powdered laboratory food for about four months. Intranuclear inclusion bodies were formed in renal tubular lining cells with smaller doses of lead than produced other changes. Decreased body weight was the next most sensitive abnormality. This was followed by increased delta-aminolevulinic acid excretion, reticulocytosis, renal edema, and aminoaciduria. Anemia only occurred at the highest lead dosage. Over a wide range of lead ingestion, urinary lead excretion remained constant, although renal lead content increased. Quantitative analysis of cell organelles showed that lead is concentrated within the inclusion bodies. Relatively small amounts of lead were present in the cytoplasm and mitochondria. It is suggested that soft-tissue lead accumulates in the intranuclear inclusion body, thereby sparing toxic injury to cytoplasmic organelles. (Author abstract modified)
APTIC-23926

### SCREENING TESTS OF PULMONARY FUNCTION.

New Engl. J. Med., 282 (22):1249-1253, May 28, 1970. 10 refs.
J. H. Comroe Jr., and J. A. Nadel.
Identifiers: *Diagnosis, *Pulmonary function, Humans, Treatment and aids, Ventilation (pulmonary), Cardiovascular diseases, Respiratory diseases.

Pulmonary function screening tests are described for the early detection of pulmonary or cardiopulmonary disease, for differential diagnosis of all patients with dyspnea, detection of the presence and extent of regional disease, evaluation of patients before intrathoracic or extrathoracic surgical procedures, determination of risk of certain diagnostic procedures, detection of early respiratory failure and the monitoring of procedures in a respiratory-care unit, quantitative evaluation of specific therapeutic procedures in patients with known bronchopulmonary disease, periodic examination of workers, and epidemiologic studies of populations to provide clues to the causes of pulmonary disease. The simplest tests measure vital capacity and maximal expiratory flow rates. To help with the detection of obstructive disorders of the pulmonary circulation, a rapid, single-breath screening test of pulmonary diffusing capacity is utilized. Abnormal results from the single-breath oxygen test indicate that some regions of the lung are filling and emptying unevenly and that there must be an abnormality in the airways or in the lung structure. The single-breath xenon test gives important information about the distribution of gas to different regions of the lungs and the rate of ventilation of these regions. A method which makes use of insufflation of powdered tantalum provides excellent bronchograms without interfering with pulmonary function. The anatomic location of areas of the lung that are poorly perfused can be detected by intravenous injection of macroaggregates of radioactive iodinated serum albumin.
APTIC-23929

### BIOLOGICAL EFFECTS OF SULFUR DIOXIDE AND FLY ASH.

Edison Elec. Inst. Bull., 38 (7):222-225, July-Aug. 1970. (Presented at the Edison Electric Institute, 38th Annual Convention, Boston, Mass., June 2, 1970.)
J. Wesley Clayton Jr.
Identifiers: *Pulmonary function, *Fly ash, *Sulfur dioxide, Guinea pigs, Primates, Pathological techniques, Cells, Liver, Respiratory functions, Mists, Sulfuric acid.

Experiments were undertaken to determine the biological effects on monkeys and guinea pigs of several concentrations of sulfur dioxide, sulfuric acid mist, and fly ash, as well as mixtures of these materials. In all of the measurements employed to assess lung performance, no adverse effects were discerned when guinea pigs inhaled 0.1, 1.0, or 5.0 ppm of SO2 in filtered air. In fact, as shown by carbon monoxide uptake, the guinea pigs breathing 5.0 ppm SO2 showed a greater ability to effect the diffusion of oxygen and carbon dioxide across lung membranes than all the animals including the controls. When the investigation was terminated after one year, the guinea pigs exposed to 5.0 ppm evidenced a reduction in the prevalence and severity of the lung changes which are the normal accompaniment of age in these animals. A slight increase in the size of the liver cells was observed, as well as an increase in liver cell vacuoles. Sulfur dioxide concentrations of 0.1, 0.5, and 1.0 ppm imposed no detriment on monkeys as indicated by body weight, lung function, blood studies, biochemical measurements, or microscopic examination of tissues. However, an accidental overexposure of 200 to 1000 ppm SO2 for about 60 minutes was responsible for a deterioration of lung function and an apparently lowered oxygen-carrying ability of the blood. Studies on fly ash particulates in which monkeys were exposed to 0.1 or 0.5 mg/cu m indicated no adverse effects of the 18-month exposure.
APTIC-23930

### LONG-TERM INHALATION SCREENING STUDIES OF BENZENE, TOLUENE, O-XYLENE, AND CUMENE ON EXPERIMENTAL ANIMALS.

Toxicol. Appl. Pharmacol., 16 (3):818-823, May 1970. 13 refs.
L. J. Jenkins Jr., R. A. Jones, and L. Siegel.
Identifiers: *Continuous, *Toxicity, *Aromatic hydrocarbons, Dogs, Guinea pigs, Primates, Rats, Mortality, Occupational health, Thresholds, Benzenes, Toluenes, Xylenes.

A study of the long-term effects of various aromatic hydrocarbons is reported. The information presented applies primarily to industrial exposures; it may eventually lead to the establishment of Confined Space Guidelines which would be applicable to humans exposed continuously for 90 days. In the experiments, rats, guinea pigs, monkeys, and dogs were exposed repeatedly, 8 hr a day, 5 days a week, for a total of 30 exposures over a 6-week period of continuously for 90-127 days to the vapors of benzene, toluene, o-xylene, or cumene. Pre- and post-exposure body weight, hematologic data, and the mortalities occurring during the exposures are presented as well as biochemical data from one of the benzene exposures. Histopathological examination of tissue sections as well as most other parameters were essentially negative. Two rats died during the continuous exposure to toluene at 389 mg/cu m. During the 3358 mg/cu m o-xylene repeated study, 2 rats died on the third exposure day, and another rat and one monkey died on the seventh day; one of the dogs exhibited tremors of varying severity throughout. One rat died on the 56th day of the continuous 337 mg/cu m exposure to o-xylene. In the 18 mg/cu m continuous cumene exposure, one rat died on the 11th day.
APTIC-23936

### PATTERNS OF ACID PHOSPHATASE ACTIVITY UNDER THE INFLUENCE OF VARIOUS DUSTS.

(Zachowanie sie fosfatazy kwasnej pod wplywem roznych pylow). Text in Polish. Polski Tygod. Lekar. (Warsaw), 25 (27):1020-1022, 1970. 20 refs.
Kazimierz Zajusz, Danuta Czapska-Dziekanowska, and Zbigniew Paradowski.
Identifiers: *Cells, *Enzymes, *Dusts, Hemoglobin interactions, Membranes, Quartz, Europe, Coal.

The effects of various dusts are studied on the reaction of acid phosphatase in macrophages cultured in vitro, and on the liberation of acid phosphatase from the lysosomal fraction of liver cells. The dusts studied include AF quartzite, FMO quartzite, anthracite, and W-1 and W-10 coal dust. The fibrogenicity of the dust is correlated with the damage to the lysosomal membranes. The investigations confirm the usefulness of the test of haemolytic activity for determination of the fibrogenic aggressivity of industrial dusts.
APTIC-23938

### AIR IONIZATION AND ITS HYGIENIC IMPORTANCE.

(Ionizatsiya vozdukha i ee gigienicheskoe znachenie). Moscow, Medgiz, 1958. Translated from Russian. Office of the Chief of Naval Operations, Washington, D. C., Translation Section, 103p., 1958. CFSTI, DDC: AD 627999
A. A. Minkh.
Identifiers: *Bioclimatology, *Diseases and disorders, *Ions, Humans, Treatment and aids, Lungs, Skin, Breathing, Cardiovascular diseases, Headache, Asthma, Bronchitis, Tuberculosis, Ussr, Buildings, Industrial areas, Air quality measurements, Ionization.

A survey of air ionization as applied to hygiene is presented. Air ions are classified as unipolar, bipolar, positive, negative, light, heavy, and according to their mobility. Their presence or absence is said to be responsible for the therapeutic attributes of health resorts. Depending upon the investigator cited, a high concentration of negative air ions will either cure or worsen asthma, rheumatism, gout, tuberculosis, high blood pressure, hypertension, angiospastic hemicrania, joint diseases, disorders of the peripheral nervous system, vagosympathetic tonus, vasomotor rhinitis, and sinusitis. These effects are reputed to be a result of electrical processes acting through the skin and lungs. One documented case among many is of a Russian researcher whose body temperature rose to 37.1 C (98.8 F) and held at that level for three days as a direct result of a predominance of positively charged air ions in the vicinity. Another researcher engaged in the systematic treatment of patients for rickets, tuberculosis, and skin diseases in acute form in an ion chamber of his own devising, with, according to his own statement, very good results. Other researchers report good results in the treatment of bronchial asthma, grippe, and cardiovascular disease. Treatment techniques are described including inhalation and the hypodermic administration of ionized oxygen. A lengthy tabulation of the ion content of the air in various health resorts, industrial centers, classrooms and in principal cities around the world is presented. In addition to the previously listed categories, consideration is given to altitude, temperature, humidity, the proximity of the ocean, and the presence of falling water. No description of measurement equipment or techniques are included. The author speaks of the extensive bibliography and frequent reference is made to substantiating graphs and figures, but none of these are included.
APTIC-23944

### THE CHATTANOOGA SCHOOL CHILDREN STUDY: EFFECTS OF COMMUNITY EXPOSURE TO NITROGEN DIOXIDE. 2. INCIDENCE OF ACUTE RESPIRATORY ILLNESS.

Preprint, National Air Pollution Control
Administration, Durham, N. C., Div. of Health
Effects Research and Chattanooga-Hamilton
County Dept. of Health, Tenn., 27p., 1970 (*). 14
refs.
Carl M. Shy, John P. Creason, Martin E.
Pearlman, Kathryn E. McClain, and Ferris B.
Benson.
Identifiers: *Nitrogen dioxide (no2), *Influenza, Acute, Adults, Children, Suspended particulates.

A study of acute respiratory illness was conducted from November 1968 through April 1969 among families residing in an area of relatively high nitrogen dioxide exposure, in an area of elevated suspended particulate exposure, and in two control areas of Greater Chattanooga by means of questionnaires and telephone follow-up. Respiratory illness rates were consistently higher in all family segments in the high nitrogen dioxide exposure area when rates were averaged for the entire 24 weeks of study, the A2/Hong-Kong epidemic period, or post-epidemic interval. A relative excess in respiratory illness of 18.8 percent was found among families exposed to elevated NO2 concentrations and an excess of 10.4 percent was found among families in the elevated-suspended particulate exposure area. (Author abstract)
APTIC-24017

### MUST WE BREATHE SULFUR OXIDES?

For primary bibliographic entry see Field 02.
APTIC-24021

### INFLUENCE OF CARBON MONOXIDE ON EFFICIENCY.

Staub, 23 (3):156-159, 1963. 3 refs. Translated from
German. Belov and Associates, Denver, Colo.,
5p., July 7, 1970.
G. Malorny.
Identifiers: *Carbon monoxide, *Health impairment, Mice, Rats, Nervous system, Germany, Exposure methods.

Exhaustibility of the rat during a swimming experiment, fatigue of mice during spontaneous physical labor, and muscular fatigue during electrical irritation of the chewing muscle of the rat were examined during and after exposure to carbon monoxide. Efficiency of the chewing muscles was distinctly decreased by the effects of CO within a concentration region of 0.025 to 0.125% vol. After the introduction of CO was stopped, the decrease in efficiency was reversible for only low concentrations, and then only partially, while permanent damage remained at high concentrations. Higher carbon monoxide concentrations were required to achieve a decrease in efficiency of the motor system in the peripheral area than for deteriorations of the central system. A 1-hr exposure of a mixture of air and of 0.05% vol CO significantly decreased the swimming efficiency of rats. Running distances were decreased by 1/2 with 48 ppm CO and by 1/3 for 55 ppm.
APTIC-24023

### STUDIES OF SANITARY NUISANCE AND HEALTH HAZARDS FROM FLUE GASES - AN INTERVIEW SURVEY.

World Health Organization, Copenhagen
(Denmark), Regional Office for Europe, Proc.
Conf. Public Health Aspects Air Pollution Europe,
Milan, Italy, 1957, p. 56-69. 3 refs. (Nov. 6-14.)
Lars Friberg, and Lars Strandberg.
Identifiers: *Opinion surveys, *Respiratory diseases, *Stack gases, *Petroleum production, Complaints, Humans, Adults, Epidemiology, Morbidity, Deposition, Bronchitis, Sweden, Odors, Dusts, Sulfur dioxide, Hydrogen sulfide.

The results are presented of interviews with about 700 residents of an area - most of it sparsely populated - up to about 20 km around a shale-oil plant emitting large quantities of flue gases (sulfur dioxide and hydrogen sulfide) and dust. Elaborate precautions were taken to prevent the persons interviewed from knowing the main object of the study, which was to investigate the sanitary nuisance and health hazards caused by flue gases. Odor and dust deposition were the principal nuisances, primarily near the shale-oil plant but also at some distance from it. An increased incidence of fatigue and upper respiratory symptoms, most of them probably bronchitis, was found near the shale-oil plant as compared with two districts further away. The difference was not attributable to variations in age and sex distribution. Nor was it, at least to any important degree, associated with the fact that most of the shale-oil workeers lived near the plant. Evidence seems to indicate that the increased frequency of these symptoms was attributable to flue gas exposure, although it is emphasized that such interviews do not provide a complete answer to questions of increased morbidity in a population group. Medical examination of selected small groups is planned.
APTIC-24037

### BIOLOGICAL AND HEALTH ASPECTS OF AIR POLLUTION.

World Health Organization, Copenhagen
(Denmark), Regional Office for Europe, Proc.
Conf. Public Health Aspects Air Pollution Europe,
Milan, Italy, 1957, p. 37-55. 32 refs. (Nov. 6-14.)
A. Giovanardi.
Identifiers: *Epidemiology, *Diseases and disorders, *Research methodologies, Area surveys, Maximum allowable concentration, Seasonal, Humans, Morbidity, Synergism, Lung cancer, Carcinogens, Respiratory diseases, Italy, Urban areas, Smokes, Domestic heating, Sulfuric acid, Benzo (3-4)pyrene, Sulfur dioxide.

Objections are raised to the concept of maximum allowable concentrations of air pollutants on theoretical and practical grounds, from the point of view of preventive medicine. Differences in mode of exposure may partly explain the differing reactions of urban dwellers and industrial workers to similar pollution levels. Research findings, including evidence of functional disorders after inhalation of sulfur dioxide and sulfuric acid in imperceptible concentrations are reviewed which indicate the great complexity in assessing the health effects of pollutants, involving such factors as synergism and the physical state and chemical and physical properties of the pollutants. Epidemiological research is hampered by the lack of measurable factors (e.g., extent, duration) for relating pollution to disease incidence, difficulties in measurement, and a lack of features in possible pollution-related ailments such as bronchitis by which causes can be differentiated. Indirect evidence and factors which complicate interpretation of a relationship between lung cancer and air pollution are reviewed. A basic air pollution research program is outlined and discussed; the studies of the Institute of Hygiene of Milan University, started in 1956, on air pollution in Milan are briefly described. Results to date indicate that pollution from SO2 and particulates is highest on foggy winter days and lowest in summer, and that smoke from fuel combustion for heating purposes probably is the main source of pollution.
APTIC-24038

### THE EFFECT OF PETROLEUM DISTILLATES ON LUNG SURFACTANT.

Aust. Paediat. J., vol. 4:229-235, 1968. 13 refs.
T. E. B. Keen.
Identifiers: *Surfactants, *Lungs, *Distillate oils, Rats, Australia, Kerosene.

The effect of 3 types of petroleum distillates on the pulmonary surfactant layer was examined by pressure volume studies on the rat lung. Kerosene, diesel fuel, and mineral seal oil were employed. When small doses of each of the distillates were introduced into the trachea, they produced a marked change in the surface properties of the lining of the lung which was dependent on the dose. Inhalation of vapors and aerosols was ineffective, and relatively large intravenous doses of distillate were required to consistently produce changes in the lung. There was no evidence that distillate absorbed from the gut could cause any alteration in pulmonary stability. The effects of these 3 substances on the lung were similar; in each case, the lung recovered its normal surface properties within 48 hours, despite the presence of discrete macroscopic areas of damage in the lung. Initial acute symptoms and signs are suggested to be the result of damage to the pulmonary surfactant layer, and aspiration is the only important cause of this type of pulmonary damage. (Author summary)
APTIC-24051

### PLAN AND ORGANIZATION OF A CROSS SECTION STUDY ON CHRONIC NONSPECIFIC RESPIRATORY DISEASES IN THE CITY OF CRACOW.

Epidemiol. Rev., 22 (3-4):236-239, 1968. 1 ref.
CFSTI: TT 68-50000/3-4
Feliks Sawicki.
Identifiers: *Cracow, *Epidemiology, *Respiratory diseases, Personnel, Chronic, Humans, Morbidity, Mortality, Europe, Urban areas, Stack gases, Dusts, Dust fall, Statistical analyses, Winds, Fog, Humidity, Rain, Temperature (atmospheric), Sulfur dioxide.

The detailed plans for the cross-sectional part of an epidemiologic study on chronic nonspecific respiratory diseases in the inhabitants of Cracow, Poland are presented. The personnel requirements of the plan are described, and their functions are discussed. The plan for the statistical analysis of the results of the study is disclosed. Analysis of environmental studies includes measurement of the mean dust concentration and sulfur dioxide level, and observations of temperature, humidity, rainfall, wind velocity, and fogs. Mortality and morbidity studies are prepared. Forms and instructions necessary to the study are described.
APTIC-24058

### LEAD IN ENVIRONMENTS.

(Kankyochu no namari). Text in Japanese. Rodo
Kagaku (J. Sci. Labour, Tokyo), 46 (10):577-583,
Oct. 10, 1970. 50 refs.
Osamu Tada.
Identifiers: *Hematology, *Urinalysis, *Lead compounds, Humans, Occupational health, Diagnosis, Japan, United states, Automotive emissions, Dusts, Fumes.

The effect of absorbed lead on human health depends on the quantity and the duration of lead absorption from the atmosphere. The amount of lead absorbed into the body through food and beverage should also be taken into account. For lead in the living environment, physiological data on lead in blood and urine were studied. For lead in the atmosphere, actual investigations conducted in the United States concerning air pollution by automobiles were studied. For lead in the occupational environment, problems due to dusts, fumes, and vapors in the working areas in Japan were investigated. Evaluating the relationship between the environmental lead and lead in the body together with the ways of diagnosing the initial physical changes due to poisoning is the main task for the future.
APTIC-24081

### INFLUENCE OF POLYVINYL CHLORIDE (PCV) DUST ON RAT RESPIRATORY SYSTEM.

(Wplyw pylu polichlorku winylu (PCW) na uklad
oddechowy szczura). Text in Polish. Roczniki
Akad. Med. Bialymstoku, vol. 24:1-48, 1969. 123
refs.
Jerzy Popow.
Identifiers: *Polyvinyl chloride (pvc), *Pneumoconiosis, *Dusts, Chronic, Rats, Cells, Bronchi, Alveoli, Toxicity, Health impairment, Emphysema, Europe, Particle size, Chlorides.

The morphological changes which occur in the lungs during the commonest pneumoconioses are discussed. Various opinions regarding the pathogenic properties of synthetic substances as a whole, and polyvinyl chloride in particular, are presented in view of the widespread use of such materials in everyday life. An experiment involving the influence of polyvinyl chloride on 60 white rats is described. The animals were exposed to polyvinyl chloride dust for one hour every day in special chambers. The exposure time and particle size of the dust were divided into three groups: one group was exposed for one to four months to particles 92% of which were smaller than 5 microns; one group was exposed 5-12 months to particles of the same size; and one group was exposed for 12 months to the same particles and then observed for 8 months without additional exposure. The animals were decapitated at intervals of one month and sections of the lungs were examined. Results indicate that dust introduced into the respiratory system is biologically active and has a mechanical and toxic effect inducing changes of the pneumoconiosis type. Specific changes in the cells of the bronchi and alveoli are mentioned, and the development of pulmonary emphysema and chronic inflammation are discussed. (Author summary modified)
APTIC-24088

### AUTOMATED MEASUREMENT OF THE INTERNAL SURFACE AREA OF THE HUMAN LUNG.

For primary bibliographic entry see Field 03.
APTIC-24092

### ON THE INITIAL FORMS OF CHRONIC CARBON DISULFIDE POISONING.

(K voprosu o nachalshchnykh formakh
khronichyeskov intoksjkatsii serouglerodom).
Text in Russian. Gigiena Truda i Prof.
Zabolevaniya, 14 (5):28-32, 1970. 2 refs.
L. E. Milkov, A. M. Monaenkova, N. K. Byalko,
K. V. Glotova, and A. G. Veretinskaya.
Identifiers: *Toxicity, *Carbon disulfide, Maximum allowable concentration, Humans, Hematology, Occupational health, Urinalysis, Blood cells, Cardiovascular diseases, Ussr.

An examination of workers exposed to the effect of carbon disulfide in concentrations of 30--60 mg/cu m disclosed the presence of the initial forms of chronic carbon disulfide poisoning in the shape of vegetative-vascular dysfunction (not infrequently with hypertensive reactions) and of the astheno-vegetative syndrome, often appearing in conjunction with signs of mildly pronounced vegetative-sensitive polyneuritis, commonly developing in persons with long service-records. In the initial forms of poisoning, a number of nonspecific changes in individual biochemical blood and urine indexes were elicited; in cases of vegetative-vascular dysfunction, a decline of the pseudocholinesterase activity and a fall of the blood chloride concentration, along with an elevated catecholamines excretion (with norpinephrine being commonly responsible for it) occurred much more often than in the asthenic form of poisoning. Persons exposed to carbon disulfide concentration not surpassing the maximum permissible level (10 mg/ cu m) also demonstrate initial forms of chronic carbon disulfide poisoning, although in fewer cases. This makes it necessary to lower the fixed maximum permissible concentration level of carbon disulfide, in consideration of the inhalation and cutaneous routes of its ingress into the organism.
APTIC-24106

### BRONCHOPNEUMONIA AND THE PRODUCTION OF FERROMANGANESE.

(Bronchopolmoniti e produzione di
ferromanganese). Med. Lavoro (Milan), vol. 38:30-
34, 1947. Translated from Italian. Franklin Inst.
Research Labs., Philadelphia, Pa., Science Info.
Services, 9p., Oct. 30, 1969.
Franco Povoleri.
Identifiers: *Bronchopneumonia, *Manganese compounds, Epidemiology, Morbidity, Drugs, Italy, Dusts, Fumes, Primary metallurgical processing, Iron compounds, Oxides.

Although the cause-effect relationship between ferromanganese production and epidemics of pneumonia in Aosta is not at all clear and convincing, no other cause can be cited to explain these events, unless one would ascribe them to a particularly malignant form of epidemic. To some extent, this malignancy could be due to the effect of manganese dioxide fumes and dust inhaled by the population in connection with an increased virulence of the pathogenic germs or, also likely, a chemical form of respiratory tract inflammation and a subsequently increasing development and virulence of the bacteria. Morbidity was similar during this period in the entire population and there was no difference in distribution related to age, sex or profession. It seemed that even the vegetation suffered greatly in the area in which the concentration of smoke was particularly dense. However, ferromanganese production was distinctly most intensive during the summer and autumn months while the highest mortality was always noted during the winter months when there was no production. The gradual disappearance of the epidemic after 1940 may be related either to a spontaneous decline in epidemic characteristics or more likely to the effects of sulfonamide therapy combined with a gradual habituation of the citizens to inhalation of manganese dioxide-laden fumes.
APTIC-24125

### ABSORPTION AND EXCRETION OF INHALED FLUORIDES.

Arch. Ind. Hyg. Occupational Med., vol. 4:585-
590, 1951. 24 refs. (Presented at the American
Industrial Hygiene Association, Atlantic City,
April 24-26, 1951.)
Gilbeart H. Collings Jr., Richard B. L. Fleming,
and Roy May.
Identifiers: *Urinalysis, *Excretions, *Absorption, *Fluorides, Humans, Occupational health, Suspended particulates, Exposure methods, Gases.

A study was undertaken to determine the response to inhaled fluorides on the part of two human subjects who had had no previous exposure to significant amounts of fluoride, and who were shown to have normal rates of fluoride excretion in the urine during periods in which they were not subjected to such exposure. As determined by the analysis of serial urine specimens, exposure to atmospheres containing either gaseous fluorides or particulate fluorides produced the same changes in the rate of the urinary excretion of fluorides over a period of time. A single exposure of eight-hour duration to approximately 3.3 mg of gaseous fluorides per cu m of air resulted in an elevation of the rate of urinary excretion of fluorides to approximately 8.1 mg per day; a similar exposure to approximately 5.0 mg of 'insoluble' fluoride dust per cu m of air resulted in an elevation to about 8.9 mg per day. In proportion to the respective atmospheric concentration, the total amount of fluoride excreted after exposure to gaseous fluorides was slightly greater than was the amount excreted after exposure to fluoride dust, but the equal rapidity of urinary changes occasioned by these two types of exposure would indicate that the two forms of fluoride are equally well absorbed by the lungs. Under conditions of usual industrial work in which 8 hours of exposure are followed by 16 hours of freedom from exposure, it is to be expected that the elevation of the rate of urinary fluoride excretion occasioned by the exposure during one work shift will have returned to normal before the next shift begins. (Author conclusions modified)
APTIC-24126

### METALLIC MICRONUTRIENTS AND INTERMEDIARY METABOLISM (U). (FINAL PROGRESS REPORT).

Dartmouth Coll., Hanover, N. H., Dept. of
Physiology, Contract DA-49-193 MD-2595, Rept.
3, 19p., June 30, 1970. 204 refs. NTIS, DDC:
AD708581
Henry A. Schroeder.
Identifiers: *Ingestion, *Metabolism, *Metal compounds, Mice, Rats, Humans, Toxicity, Carcinogens, Cardiovascular diseases, Trace analysis.

In order to evaluate biological effects of trace elements, and to ascertain relationships to chronic diseases of man, mice and rats were exposed for their lifetimes to small doses of each of 26 essential and abnormal elements in drinking water. Growth rates, survival and longevity, microscopic pathology of tissues, concentrations of trace elements in tissues, blood pressure, serum cholesterol, glucose and uric acid, aortic plaques and lipids and tumor rates were measured or examined. Surveys of the human environment for 21 elements in foods, water, vegetation, and wild animals were also made, by trace analysis, and human tissue concentrations for 6 elements. Selenite, germanate, cadmium, tin, antimony, tellurium, and lead were more or less toxic in mice and/or rats, while scandium, titanium, vanadium, nickel, gallium, arsenite, zirconium, niobium, and indium were more or less inert. Chromium, manganese, iron, cobalt, copper, zinc, molybdenum, and fluoride were essential. Hypercholesteremia was caused by a deficiency of chromium, while hyperglycemia was caused by a deficiency of manganese or chromium. Selenium, yttrium, rhodium, palladium, and tellurate were carcinogenic. A model for human arterial hypertensio was developed in rats fed cadmium, while a model for human atherosclerosis was developed in rats deficient in chromium and in those fed refined white sugar. (Author summary modified)
APTIC-24127

### PATHOLOGY OF ANIMALS EXPOSED CONTINUOUSLY FOR 90 DAYS TO O3 OR NO2 IN AMBIENT AIR OR 100% OXYGEN AT 5 PSIA.

Aerospace Medical Research Lab., Wright
Patterson AFB, Ohio, Proc. Conf. Atmos.
Contamination Confined Spaces, 3rd Annu.,
Wright-Patterson AFB, Ohio, 1967, 145-155. 2
refs. (May 9-11.)
Farrel R. Robinson, Roger L. Sopher, and Omer
E. Hagebusch.
Identifiers: *Toxicity, *Nitrogen dioxide (no2), *Ozone, Laboratory animals, Mortality, Pathological techniques, Lungs, Adaptation, Thresholds, Pulmonary edema, Exposure methods.

Toxicological experiments were conducted to evaluate the biological response or animals exposed continuously for a 90-day period in either ambient air or 100% oxygen at 5 psia to threshold limit values of ozone and nitrogen dioxide. Monkeys, beagle dogs, rats, mice, and sometimes guinea pigs were exposed in Thomas domes to TLV concentrations of O3 and NO2 actually measured at 0.19 and 9.3 mg/cu m, respectively. Mortality data were unremarkable except for the deaths at 720 mm Hg pressure in the O3 experiments where mice seemed to be more sensitive than the other three species. Most of the deaths occurred during the first half of the 90-day exposure, suggesting some degree of adaptation in the survivors. Qualitative but not statistically significant changes were observed in the serum glutamic oxaloacetic transaminase and serum glutamic pyruvic transaminase levels in dogs exposed to O3 and NO2, with a slight rise in SGPT in monkeys exposed to NO2. Gross lesions in the lungs of the dog and mice that died were typical of the pulmonary irritants, O3 and NO2, in that there was massive hemorrhage and edema of the lungs. There were indications in some experiments, for instance the dogs exposed to O3 at 5 psia, that the extent and severity of endemic disease was greater in exposed dogs as compared to controls and was possible accentuated as a result of the exposure.
APTIC-24132

### INTERACTIONS OF GASEOUS AIR POLLUTANTS WITH EGG LECITHIN AND PHOSPHATIDYL ETHANOLAMINE MONOMOLECULAR FILMS.

For primary bibliographic entry see Field 06.
APTIC-24146

### TOXICOLOGIC ASPECTS OF FLAMMABILITY AND COMBUSTION OF POLYMERIC MATERIALS.

J. Fire Flammability, vol. 1:239-268, July 1970. 28 refs. (Presented at Polymer Conference Series, 'Introduction to Flammability and Characteristics of Polymer Materials,' University of Utah College of Engineering, June 15-20, 1970.)
John Autian.
Identifiers: *Toxicity, *Plastics, *Aliphatic hydrocarbons, *Combustion, Humans and animals, Health impairment, Textiles, Chlorides, Cyanides, Fluorides, Aromatic hydrocarbons, Carbon dioxide, Carbon monoxide, Nitrogen oxides, Sulfur dioxide, Oxygen, Hydrogen sulfide.

The toxicity problems which may result from the burning or heating of manmade polymeric materials (plastics, elastomers, and textiles) are reviewed at length. After a general discussion of the burning of manmade materials and of toxicology in real fire situations, the effects of some of the more important thermal degradation products are summarized, including carbon monoxide; sulfur dioxide, hydrogen sulfide, hydrogen fluoride, chloride, and cyanide; aliphatic hydrocarbons, aromatic hydrocarbons, nitrogen compounds, and epoxy compounds. Toxic effects from polymer 'fumes' and from smoke are also considered. The literature on laboratory experimentts on the toxicity of these products is reviewed, and the need for the development of standardized toxicity testing procedures is stressed. Three levels of toxicity testing are proposed: level I deals with 'life and death' possibilities, level II with toxic effects at sub-lethal concentrations in animals, and level III with ultimate prediction of toxicity on the basis of pertinent data about the degradation products. It is emphasized that, besides the prime attention traditionally accorded to acute toxicity, toxicity consideration must be extended to include possible health effects from lower concentration of the gases and exposures over longer time periods now that new materials are being used for all types of items, including housing units, and with increasing air pollution from industrial process or from municipal trash incineration. An extensive introduction to toxicology is included as an appendix.
APTIC-24153

### HISTOPATHOLOGICAL STUDY OF THE RAT RESPIRATORY ORGAN EXPOSED TO SULPHUR DIOXIDE.

(Aryusangasu Kyunyu daikoku nezumi kokyuki no byori soshikigakuteki kenkyu). Text in Japanese. Nara Igaku Zasshi (J. Nara Med. Assoc.), 21 (3):267-281, Sept. 14, 1970. 20 refs.
Kimihiro Yamamoto.
Identifiers: *Respiratory system, *Toxicity, *Sulfur dioxide, Rats, Pathological techniques, Cells, Cilia, Japan.

Pathological changes were observed in the respiratory organs of rats exposed to 50-100 ppm or 700-1000 ppm of sulfur dioxide for periods of one day to 25 weeks. Extensive pathological observations were made in airways and alveoli by horizontal longitudinal sections of the total lungs with the trachae. In addition, histological type of airway epithelium were classified. Airway epithelim of exposed rats exhibited disappearance of cilia, erosion, increase of mucous cells, squamous cell metaplasia, and hyperplasia. Also observed was elongation of epithelial cells from terminal bronchiole to alveolar walls. Infiltration of small round cells and proliferation of collagen fiber were found in peritracheae, peribronchi, and peribronchioles. There was also perivascular infiltration and congestion in alveoli capillaries, and infiltration of small round cells in alveolar walls and alveoli. Abscesses progressed from bronchus were noted in the lungs of rats exposed to 700-1000 ppm SO2. In general, there were no marked differences between pathological changes following exposure to 50-100 ppm SO2 and those following exposure to 700-1000 ppm.
APTIC-24154

### FLUOROCARBON EFFECTS ON TISSUE METABOLISM.

Fed. Proc., 29 (5):1746-1750, Sept.-Oct. 1970. 9 refs.
Hugh L. Spitzer, George Sachs, and Leland C. Clark Jr.
Identifiers: *Tissues, *Metabolism, *Fluorinated hydrocarbons, Guinea pigs, Mice, Lipids, Nucleic acids, Isotopes.

Because of the potential usefulness of fluorocarbons for dissolving large quantities of gases, in vivo and in vitro experiments were conducted to determine fluorocarbon effects on tissue metabolism. The in vivo experiments involved injecting female mice with 32PO4 or choline methyl-3H plus 32PO4, then placing the mice in a fluorocarbon bath. The animals were later sacrificed to determine isotope incorporation into phospholipids, ATP, and nucleic acids. For the in vitro experiments, guinea pig or Rana pipiens gastric mucosa were stripped of the external muscle layer and examined for the effects of fluorocarbon perfusion. The most striking finding was the marked reduction of 32PO4 incorporation into phospholipids. Fluorocarbon perfusion resulted in increased rather than decreased secretion, suggesting that the fluorocarbon does not interact significantly with the lipids of membranes. These data further suggest that the presence of fluorocarbon probably increases the availability of oxygen transported to the tissue, thus explaining the higher rate of secretion.
APTIC-24170

### TOXIC PROPERTIES OF HERBICIDE JALAN ENTERING THE ORGANISM BY THE RESPIRATORY ROUTE.

For primary bibliographic entry see Field 11.
APTIC-24171

## 8. EFFECTS - PLANTS AND LIVESTOCK

### EFFECTS OF FLUORINE. RESULTS OF INVESTIGATIONS WITH PLANTS AND ANIMALS.

For primary bibliographic entry see Field 03.
APTIC-18264

### INVESTIGATIONS OF THE FLUORINE INTAKE BY PLANTS FROM THE SOIL.

(Untersuchungen ueber die Aufnahme von Fluor aus dem Boden durch Pflanzen.) Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, Contract No. CPA 22-69-30, Project No. C 2439, 20p., 1968. 9 refs.
K. Garber, R. Guderian, and H. Stratmann.
Identifiers: *Fluorine, *Plants (botany), *Plant growth, *Germany, Plant damage, Chemical methods, Fluorine compounds.

This paper deals with the fluorine intake from the soil, and in particular, answers to the following questions are sought: 1. How great is the fluorine concentration of various types of plants grown in different soils° 2. What effect has a portioned fluorine addition to the soil on the F-concentration of the plant° 3. Are there fluctuations in the fluorine concentration of the plant during its vegetation period° 4. Are there any connections between the F-concentrations of various plant organisms° All investigations were performed in vitro and are based on the experiments on sulfur dioxide effects described by von Guderian (1960). The sites of the investigations are Hamburg, Biersdorf (Sieg) and Kettwig. With the majority of the experiments, the experiments, the computed fluorine concentrations were mixed with the soil prior to sowing. To determine the F-concentration in the experimental soils as well as in the sample plants the method by Oelschlager (1960) was used. The same types of plants show different F-concentrations which moreover do not correlate with the fluorine concentrations of the soils. The fluorine concentration of plants thus is not solely a function of the absolute fluorine concentration of the soil.
APTIC-18265

### THE FLUORINE CONCENTRATION OF PLANTS.

(Ueber den Fluorgehalt von Pflanzen.) Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, Contract No. CPA 22-69-30, Project No. C 2439, 10p., 1968. 10 refs.
K. Garber.
Identifiers: *Fluorine, *Plants (botany), *Crops, *Vegetables, *Germany, Fruits, Leaves, Fluorine compounds.

Data are presented which indicate (1) that the fluorine intake by plants is independent of the fluorine concentration of the soil, and (2) that the natural fluorine content of plants lies between 0.2 and 2.0 (maximum 3.0) mg per 100g dry substance. Any higher concentrations can be traced to F containing immissions.
APTIC-18266

### INVESTIGATIONS INTO THE EFFECTS OF FLUORINE IMMISSIONS ON CATTLE IN THE NEIGHBORHOOD OF A HYDROFLUORIC ACID PLANT.

(Untersuchungen ueber Fluorimmissionwirkungen bei Rindern im Bereich einer Flussaeure-Fabrik.) Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, Contract No. CPA 22-69-30, Project No. C 2439, 29p., 1968. 10 refs.
G. Rosenberger, and H.-D. Gruender.
Identifiers: *Fluorine, *Cows, *Experimental methods, *Fluorosis, Cattle, Urinalysis, Bones, Ingestion, Chemical processing, Field tests, Testing facilities, Hydrofluoric acid, Fluorine compounds.

During the period of 3.5 years, twelve cows were kept under controlled conditions on a farm located in the emission area of a hydrofluoric acid plant. At the beginning of the test program the age of the cattle ranged from 3/4 to 9 years. The investigations covered the computation of the fluorine intake through the forage, the water and the air as well as the excretion by urine and incorporation in the bones. The state of health and the productivity of the cattle was constantly observed. The fluorine content of the farm-produced forage varied largely depending on the situation of the forage land with respect to the industrial plant. The monthly average of fluorine intake of the cattle varied between 1.0 and 9.5 mg F per kg body weight. All cattle showed symptoms typical for chronic fluorine poisoning, i.e. changes in teeth and bones as well as disturbances in locomotion. No influence of the fluorine intake could be detected on the fertility or on the milk productivity if this was less than 20 liters per day. Calves of cows with chronic fluorosis were not injured but do have an increased fluorine content of their bones.
APTIC-18268

### EFFECTS OF FLUORINE ON CATTLE UNDER EXPERIMENTAL AND PRACTICAL CONDITIONS.

(Fluor-Wirkungen beim Rind unter experimentellen und praktischen Bedingungen.) Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, Contract No. CPA 22-69-30, Project No. C 2439, 31p., 1968. 16 refs.

K. Trautwein, and Ch. Kopp.
Identifiers: *Fluorosis, *Cows, *Industrial emission sources, *Sodium fluoride, *Cryolite, Cattle, Grasses, Urinalysis, Bones, Ingestion, Reproduction, Aluminum, Industrial areas, Primary metallurgical processing, Chemical methods, Experimental methods, Fluorine compounds, Aluminum compounds, Sodium compounds, Economic losses.

In the period from 1961 to 1967 fluorosis was experimentally induced in test cattle by feeding them primarily with locally grown, fluorine-containing forage to which sodium fluoride or cryolite had been added. The total fluorine intake by the NaF-fed cows was 1.94 mg F/kg body weight per day, and by cryolite-fed cows 2.48 mg F/kg body weight per day. The fluorine intake thus exceeded the threshold value of about 1.75 mg F/kg body weight per day given in the pertinent literature. Fluorine elimination with the feces was found to be about 0.5 g of F per animal per day with NaF-fed cows and 0.9 g of F per animal per day with cryolite-fed cows. Along with the urine, 0.45 mg of F per animal per day were discharged by NaF-fed cows and 0.3 mg of F per animal per day by cryolite-fed cows. The analysis of tail vertebrae biopsies yielded a fluorine retention of 245 to 890 mg F/100 g ash over the period from 1960 to 1966 for the NaF-fed cows, and of up to 655 mg F/100 g ash for the cryolite-fed cows. The clinical symptoms of fluorosis were slight to moderate yellowish, brownish spots as well as hypoplasia of the incisors, furthermore, weak and temporary functional disturbances of the motility were observed with some cows. The severity of these clinical symptoms were found to be dependent on the degree of fluorine emission. The general physical condition as well as the productivity of the test cows were in most cases satisfactory to excellent. Observations concerning spontaneous fluorosis in the Rheinfelden (Baden) emission area during the past 15 years show that the number and the severity of the disease in six communities had reached a peak in 1958 from whereon a steady decrease of the number of cases is found. This downward trend was parallelled by a decrease of the average fluorine content in the locally grown forage below the tolerance limit.
APTIC-18269

## THE RESORPTION OF FLUORINE BY OXEN FROM SOIL AND FLY DUST OF AN ALUMINUM PLANT.

(Die Resorption von Fluor durch Ochsen aus Erde und Flugstaub einer Alluminiumhuette.)
Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, Contract No. CPA 22-69-30, Project No. C 2439, 15p., 1968. 8 refs.
W. Woehlbier, W. Oelschlaeger, G. Gronbach, and H. Giessler.
Identifiers: *Fluorine compounds, *Forage, *Cattle, *Fluorosis, *Industrial emission sources, Urinalysis, Bones, Digestion, Ingestion, Aluminum, Germany, Fly ash, Metal fabricating and finishing, Experimental methods.

The resorption and retention of fluorine contained in three different substances such as NaF, fly dust from an aluminum plant and soil intermingled with fly dust which probably underwent a secondary fluorine reaction. All substances contained a fluorine compound with a relatively high water solubility. The fluorine retention was relatively high with soil, the fluorine excretion in the urine low. The supplementary feeding of the three fluorine-containing substances extending over 316 days brought various high levels of fluorine depositions which agreed with the quantities resorbed.
APTIC-18270

## INVESTIGATIONS ABOUT THE INITIAL STAGES OF THE MORPHOLOGICAL CHANGES OF ORGANS AND TISSUES IN DOMESTIC ANIMALS WITH FLUORINE POISONING.

(Untersuchungen ueber die Anfangesstadien der morphologischen Organ- und Gewebsveraenderungen bei Fluorvergiftung der Haustiere.) Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, Contract No. CPA 22-69-30, Project No. C 2439, 10p., 1968. 11 refs.
P. Cohrs, H. Knosel, and Kl. Witte.
Identifiers: *Fluorosis, *Hogs, *Sheep, *Experimental methods, *Fluorine compounds, *Fetuses, Cattle, Foods, Bones, Glands, Sodium compounds.

Experiments are described in which sheep, pregnant sows, and weaned piglets were given fluorine orally in the form of an aqueous solution of sodium fluoride. Histological investigations were made and all organs, especially the endocrine glands, were investigated using usual methods and procedures. The fetuses of pigs and the suckling piglets showed no pathological changes in their developing teeth, in their bones and endocrine glands. Weaned piglets showed varied changes in teeth and bones according to the dose and duration of the application of NaF. Considerable weight reductions were observed in the thymus and adrenal glands of the test animals. No changes were observed in the pregnant sows. Sheep and lambs showed the same changes in teeth and bone tissue as were observed in the weaned piglets.
APTIC-18271

## LABORATORY AND FIELD INVESTIGATIONS OF FLUORINE EFFECTS OF BEES.

(Laboratoriums-und Felduntersuchungen ueber Fluor-Wirkungen bei Bienen.) Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, Contract No. CPA 22-69-30, Project No. C 2439, 10p., 1968. 22 refs.
K. Trautwein, R. Buchner, and Ch. Kopp.
Identifiers: *Bees, *Fluorine compounds, *Industrial emission sources, *Field tests, Animals, Flowers, Fluorosis, Germany, Metal fabricating and finishing, Fluorine.

According to experiments, no damages occurred to bees through dust and powdery substances containing fluorine. The following toxicity of dissolved fluorine compounds was found: a) Sodium fluoride; lethal dose equals 20 micrograms F per bee per 24 hours; 50% lethal dose equals 11 micrograms F per bee per 24 hours. b) Hydrofluoric acid lethal dose equals 10 micrograms F per bee per 24 hours; 50% lethal dose equals 5 micrograms F per bee per 24 hours. There are different sensitivities between the strains of bees and there is a repellent effect of hydrofluoric acid depending on its concentration. In 57 samples of 100 normal bees each, average values between 0.63 to 4.81 micrograms F per bee were found. The bees came from various regions with and without fluorine emissions. In the Rheinfelden emission area, only normal values of 0.6 to 2.8 micrograms F per bee were found in bees which were said to have died from fluorine emissions. Test colonies at a distance of 300 m from the plant showed no disorders after three years. In the Seelze emission region limiting values from 0.9 to 10.6 micrograms F per bee were found in bees which were said to be injured by fluorine emissions. Of two test colonies placed at a distance of 300 m from the plant, one died, the other developed badly during the three years of observation. In the examination of bees which are suspect of fluorine intoxication, other important diseases and aggravating factors must be recognized by differential diagnosis.
APTIC-18272

## PHYSIOLOGICAL AND BIOCHEMICAL CONTRIBUTIONS TO THE RESEARCH OF FLUE-GAS DAMAGE. REPORT 11: ANALYSES OF SOME CONTENTS OF SPRUCE NEEDLES HAVING DIFFERENT INDIVIDUAL FLUE-GAS HARDNESS ORIGINATING FROM A DAMAGE ZONE.

(Physiologische und biochemische Beitrage zur Rauchschadenforschung. 11. Mitteilung: Analysen einiger Nadelinhaltsstoffe and Fichten unterschiedlicher individueller Rauchharte aus einem Schadgebiet.) Arch. Fortswes., 18:123-131, 1969. Translated from German.
Siegrried Bortitz.
Identifiers: *Photosynthesis, *Stack gases, *Sulfur dioxide, Plants (botany), Trees, Plant damage, Plant growth, Cell metabolism, Metabolism, Europe, Germany, Forests, Mountains, Combustion products, Combustion gases, Particulates, Suspended particulates, Fumes, Sulfur oxides, Chronic.

Spruce needles from a mountainous area were examined after continual subjection to short periods of relatively high levels of atmospheric sulfur dioxide contamination. The metabolism of plants damaged to different degrees by flue gases was investigated to determine reasons for resistance based on internal structure. Paper chromatography was used for carbohydrate analysis and tannin content determined by titration with potassium permanganate. pH analyses were made using methods previously developed for needle analysis. The first sign of SO2 damage is a foster aging of the needles of less resistant trees. Suprisingly, the level of active photosynthesis did not decrease significantly in the damaged needles, but the faster aging process and resulting net loss of needles reduced the total tree activity and material storage. In contrast to needles of resistant trees, those of damaged spruces have a lower water content, a higher sugar level, a lower acidic buffer capacity, and a higher pH in their cell sap. This last finding is unexpected in light of the acidic nature of flue gas. The degree of these effects shows a dependence upon the time of year. Comparisons with other studies shows an apparent influence on the type of SO2 damage of the degree and length of exposure to the pollutant flue gas.
APTIC-18310

## PERTAINING TO THE RELATIONSHIP OF THE ECTODESMATA TO THE UPTAKE OF NOURISHMENT THROUGH THE LEAVES. III. REPORT. PROOF OF THE PARTICIPATION OF THE ECTODESMATA ON THE UPTAKE OF NOURISHMENT THROUGH THE LEAVES BY MEANS OF RADIOACTIVE SUBSTANCES.

(Ueber die Beziehungen der Ektodesmen zur Stoffaufnahme durch Blaetter. III. Mitteilung. Nachweis der Beteiligung der Ektodesmen an der Stoffaufnahme durch Blaetter mittels Radioaktiver Stoffe). Planta, vol. 61:1-16, 1964. 14 refs. Translated from German. Belov and Associates, Denver, Colo., 20p., Feb. 10, 1970.
Wolfgang Franke.
Identifiers: *Absorption, *Transport, *Ectodesmata, Leaves, Spinach, Cells, Germany, Isotopes, Radioactive tracers.

The role of ectodesmata in the uptake of nourishment through leaves was investigated by means of a radioactive tracer. When droplets of radioactive solutions were applied to the cuticle of Spinacio oleracea and Viola tricolor, micro-auroradiograms showed that the guard cells and anticlinal walls of the epidermis are the favored sites of absorption. Scattered black spots in the stripping film were also observed above the periclinal walls of the epidermis. Comparison of the micro-autoradiograms with the distribution of the ectodesmata in the leaf epidermis showed that the areas of absorption correspond to the areas of the densest accumulation of ectodesmata; the ectodesmata in the less absorbing preclinal walls are more loosely dispersed. This agreement is considered as proof that the ectodesmata serve as transport tracks for the intake of substances through leaves. These experiments confirm earlier statements that guard cells participate in foliar absorption. The micro-autoradiograms also show that absorption does not occur through the pores of the guard cells. (Author summary modified)
APTIC-22198

### ON THE DAMAGE TO PLANTS BY AMMONIA GASES AND THEIR IDENTIFICATION.

(Ueber Schadigung von Pflanzen durch
Ammoniak-gase und ihren Nachweis). Z.
Pflanzenkrankh. Pflanzenschultz, vol. 42:457-465,
1932. 21 refs. Translated from German. Belcv and
Associates, Denver, Colo., 16p., May 31, 1970.
G. Bredemann, and H. Radeloff.
Identifiers: *Plant damage, *Ammonia, Flowers, Trees, Vegetables, Tomatoes, Germany, Sulfur dioxide.

Studies were conducted to compare the effects of exposure to ammonia on potted trees, potted flowers, and full-grown tomatoes kept in the light with the effects observed on the same plants kept in the dark. Trees kept in the dark and exposed for two hours to approximately 1:4000 NH3 always suffered more severe damage than trees kept in darkness. However, the difference was not as pronounced as that recorded for sulfur dioxide damage and was confined to a narrowly limited range of concentrations. Darkness did not protect trees against increased NH3 concentrations as it does against high SO2 concentrations. Among the six tree species tested, ash was the most susceptible to NH3 damage and oak, maple, and sitca spruce the least susceptible. Intermediate positions were occupied by beech and rose trees. This classification of trees according to their resistance coincides with the results of tests for the effects of SO2. As confirmed by the tests with tomatoes and flowers, NH3 damage is characterized by the decomposition of chlorophyll and the precipitation of tannin and is thus confined to green leaves. The crown leaves of flowers and tomato blossoms were not damaged by exposure.
APTIC-22232

### THE LIMITS OF SULFUR DIOXIDE EFFECTS UPON PLANTS.

Staub (English translation from German of: Staub, Reinhaltung Luft), 29 (9):36-38, Sept. 1969. 11 refs.
Richard Zahn.
Identifiers: *Plants (botany), *Statistical analyses, *Sulfur dioxide, Air quality criteria, Germany.

New opinions regarding the resistance of vegetation to sulfur dioxide cite the damage limit for plants is not to be 0.2 ppm, as previously assumed, but 0.02 ppm. Methods used to obtain the 0.2 ppm value are discussed and the value is compared to mean values of SO2 concentration over an extended period of 0.02 ppm. The constant concentration of 0.2 ppm used in an extended fumigation test and the mean value of 0.02 ppm (obtained in an industrial region comprising many different individual values) are not comparable in their effects on plants. Neither mean values over extended periods, nor maximum allowable concentrations, are suitable criteria for characterizing and assessing SO2 immissions. The former are not precise and liable to constitute a hazard to vegetation, the latter are too rigid. Immission limits must have a certain flexibility, which is probably best achieved by replacing fixed values with a cumulative frequency curve.
APTIC-22280

### HISTOLOGICAL RESPONSES OF SOME PLANT LEAVES TO HYDROGEN FLUORIDE AND SULFUR DIOXIDE.

Am. J. Botany, vol. 43:755-760, Dec. 1956. 20 refs.
Richard A. Solberg, and Donald F. Adams.
Identifiers: *Fluorides, *Sulfur dioxide, *Plant damage, Fruits, Leaves, Pinto beans, Tomatoes, Necrosis, Chloroplasts, Cells, Microscopy.

The effects of hydrogen fluoride and sulfur dioxide on plant leaves were investigated. Morpark apricot, Italian prune, and Winesap apple trees were fumigated eight hours daily, five days per week, at 5 ppb HF. Pinto bean and tomato seedlings were fumigated with 0.5 ppm SO2 and 5 ppb HF. Fumigations with a mixture of HF and SO2 were conducted with the same concentrations in combination. Samples of injured and control leaves were processed microtechnically and examined microscopically. Histological responses to HF and SO2 were indistinguishable. Microscopic injury was first apparent in the spongy mesophyll cells and the lower epidermal cells. The mesophyll cells were readily injured and the most common degree of injury was total collapse; the lower epidermal cells were observed to distort and collapse when the mesophyll cells did. Disintegration of the chloroplasts occurs in those cells injured by HF and SO2 before complete collapse of all the leaf tissues occurs. Various postulates are discussed concerning the means and pathways by which a phytotoxic air pollutant may enter the leaf and produce injury.
APTIC-22284

### FUNGAL DISEASES OF BANANAS IN HAWAII.

Plant Disease Reptr., 53 (1): 63-66, Jan. 1969. 31 refs.
Donald S. Meredith.
Identifiers: *Plant damage, *Hawaii, *Fungi, *Bananas, Fruits.

Fungal diseases of bananas are listed that have been recorded in Hawaii to date, together with the causal fungi and the appropriate references for further information on the diseases. Banana leaf spot disease caused by one or more species of Mycosphaerella, having a Cercospora in perfect stage, is common in Hawaii, but the precise identity of the species involved is still in doubt.
APTIC-22302

### THE EFFECT OF COAL GAS ON THE VEGETATION OF TREES.

(Einfluss des Leuchtgases auf die
Baumvegetation). Jahresber. Agrikultur, vol.
13:236-237, 1870-1872. 4 refs. (Also: Nachr. Botan.
Z., 89 (50-51), 1871 and Der Naturforscher. 1872.)
Translated from German. Belov and Associates,
Denver, Colo., 3p., May 17, 1970.
Kny.
Identifiers: *Plant damage, *Combustion gases, *Coal, Leaves, Trees, Toxic tolerances, Germany, Fuel gases.

Experiments were conducted on two linden trees and one maple to determine the effects of coal gas on their vegetation. Each linden tree had two pipes installed at a depth of 84 cm and each was supplied with a burner at a distance of 110 cm from the trunk. The maple was supplied with four burners, 118 cm from the trunk. Three gas meters were used to determine the daily amount of coal gas to which the trees were exposed. The damaging effect of the coal gas became apparent with a specimen of evonyums, which was next to the maple. Within a short time, the leaves of the maple and of an elm tree at a distance of 2.8 m began to wilt. Within three months, the linden trees were completely defoliated. The roots showed a blue coloration which progressed from the center to the periphery. This indicated that the coal gas had penetrated along the growing root ends and not through the bark of the older root parts. Within several months, the maple, elm, and evonyums bushes were completely destroyed; their wood was dead, their cambium withered, and the maple showed a prolific fungi formation. Although the linden trees grew leaves at the normal time, they had a pale coloration and were smaller than normal. Also, the cambium withered and the side of the trunk nearest the gas meters showed the same fungi formation as the maple. These tests show the effects of coal gas on tree vegetation and the varying sensitivities of different speices to coal gas.
APTIC-22316

### USE OF VEGETATION TO MEASURE AIR POLLUTION.

Preprint, Inst. Mexicano de Ingenieros Quimicos,
10p., 1961. (Presented at the Instituto Mexicano de
Ingenieros Quimicos, Annual Technical Meeting,
Mexico City, Mexico, Oct. 19-21, 1961.)
Herbert C. McKee.
Identifiers: *Area surveys, *Plant indicators, Survey methods, Plant damage, Smog, Phytotoxicants, Sulfur dioxide.

The sequence of procedure in the conduct of an air pollution survey based on plant damage is delineated. The first step is field inspection of all vegetation in the area by a trained plant scientist to determine damage caused by pollution vs. damage from other factors, and possibly to locate sources of local pollution. Samples are then collected and analyzed, by prescribed methods to identify the atmospheric pollutants that have caused the damage. The importance of having control samples is stressed. An example of the use of vegetation techniques in an air pollution survey is given for Houston, Tex. The area was divided into sectors and samples obtained for analyses from each section throughout the year; these values were then used in computing a pollution index based on vegetation damage. Native elm and the Arizona ash were studied as indicators of sulfur dioxide pollution. Vegetation symptoms could be used readily to obtain information on general pollution conditions in the Houston area, and that despite the limitations of the method, the pollution indexes thus derived provided data which could only be obtained at great expense using atmospheric analysis techniques. A table is included on the use of plants in determining pollution, via visible damage and chemical analysis, for 10 general types of phytotoxic air pollutants.
APTIC-22485

### TREES AND SHRUBS FOR MAKING THE DONETS COAL BASIN VERDANT.

In: American Institute of Crop Ecology Survey of
USSR Air Pollution Literature. Effects and
Symptoms of Air Pollutes on Vegetation;
Resistance and Susceptibility of Different Plant
Species in Various Habitats, In Relation to Plant
Utilization for Shelter Belts and as Biological
Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver
Spring, Md., American Institute of Crop Ecology,
1969, p. 85-89. (Also: Byulleten' Glavnogo Botan.
Sada., (Moscow), vol. 45:34-37, 1962.)
M. P. Voloshin.
Identifiers: *Trees, *Toxic tolerances, Ussr, Urban areas, Combustion gases, Smokes, Temperature (atmospheric).

In 1960, the major green plantings of the cities and workers settlements in the Donets oblast' were studied to determine the most promising trees and shrubs that have proved to be hardy under local environmental conditions. The methods of investigation consisted of plant inspection with checks on the plants' origin, their reaction to growth conditions, and the interrelations between various species. The experience attained in park establishment was studied in relation to natural conditions and the objective and purpose of the planting. Plants found to suffer from frost and drought are listed. Plants that are resistant to high gas and smoke concentrations include quince, black locust, prevet, crenulate and fuzzy deutzia, garden woodbine, oleaster, hoptree, Japanese pagoda tree, eastern poplar, and white mulberry. In areas of low and average smoke pollution, several additional species can be added to this list. For the planting of refuse dumps and waste piles, black locust, apricot, box elder, Tartar honeysuckle, and several others are recommended. For forest belts and green tracts around cities and workers villages, the principal species is the common oak. Several species are also recommended for plantings on slopes and wasteland.
APTIC-22489

### THE EFFECT OF INDUSTRIAL GAS ON THE GROWTH OF TREES AND SHRUBS.

In: American Institute of Crop Ecology Survey of
USSR Air Pollution Literature. Effects and
Symptoms of Air Pollutes on Vegetation;
Resistance and Susceptibility of Different Plant
Species in Various Habitats, In Relation to Plant
Utilization for Shelter Belts and as Biological

Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver
Spring, Md., American Institute of Crop Ecology,
1969, p. 13-18. 6 refs. (Also: Akad. Nauk USSR
Vsesoyuznoe botan. obschestuo. Zh. Botan., 47
(3):412-416, 1962.)
V. M. Ryabinin.
Identifiers: *Trees, *Plant damage, *Combustion gases, Leaves, Photosynthesis, Respiration, Metabolism, Ussr, Smokes, Hydrochloric acid, Nitrogen oxides, Sulfur dioxide, Hydrogen sulfide.

Industrial gases disturb the physiological and biological processes of plants. To study the growth and viability of certain trees under smoke pollution conditions, three experimental plots were laid out in the Shchelkovo Forest of the Moscow district. The effects of sulfur dioxide, nitrogen oxides, hydrogen sulfide, and hydrogen chloride were observed. Three control plots were established in the Malakhov Forest. The results showed that under the influence of industrial gases there is a decrease in the size of needles and leaves, and the life span of needles is half what it would normally be. The assimilating surface of the trees and shrubs is thus sharply decreased. A weakening of growth was observed in coniferous and deciduous species; the cause is the repression of photosynthesis due to the reduction of assimilating surface. With an increase in distance from the pollution source, the difference in growth between exposed and control trees gradually disappears.
APTIC-22490

### EFFECT OF INDUSTRIAL POLLUTANTS ON THE VEGETATION OF BASHKIR A.S.S.R.

In: American Institute of Crop Ecology Survey of
USSR Air Pollution Literature. Effects and
Symptoms of Air Pollutes on Vegetation;
Resistance and Susceptibility of Different Plant
Species in Various Habitats, In Relation to Plant
Utilization for Shelter Belts and as Biological
Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver
Spring, Md., American Institute of Crop Ecology,
1969, p. 19-23. (Also: Akad. Nauk SSSR Ural.
Filial. Ural. Gos. Univ. im A. M. Gor'kogo
Okhrana prirody na Urale. (Sverdlovsk), 4:163-
168, 1964.)
[illegible] Kucherov, and B. E. Fedorako.
Identifiers: *Trees, *Plant damage, *Stack gases, Leaves, Tip burn, Plant growth, Toxic tolerances, Ussr, [illegible]sts, Soot, Smokes, Petroleum refining.

Most plants, particularly conifers, are very sensitive to gas pollution which causes arrested growth and changes in the color of leaves and foliage. At small gas concentrations, the edges of leaves curl and foliage yellows, while at higher concentrations burns appear; leaves turn brown and wilt. This causes premature, partial, and complete defoliation. In 1950, various species of trees and shrubs were planted on the grounds of a Russian refinery. Red ash showed a high gas resistance; although its leaves curl, it gives an annual height increment. The leaves of little leaf linden yellow and curl, and those of the European white birch yellow prematurely. Balsam poplar leaves yellow, turn brown, and drop prematurely. Under conditions of prolonged gas pollution of low concentration, all deciduous trees are more resistant than conifers. It is recommended that protective plantings be established near industrial enterprises, in open areas between them, and directly on their grounds. These plantings should consist of thick, multistage trees and shrubs, such as poplar, linden, apple, hedgerow rose, Siberian pea shrub, Tartar honeysuckle, raspberry, and black currant. Such plantings will change the gas composition of the air for the better.
APTIC-22491

### THE GAS RESISTANCE OF LOCAL AND INTRODUCED ARBOREAL PLANTS UNDER THE CONDITIONS EXISTING IN SVERDLOVSK OBLAST'.

In: American Institute of Crop Ecology Survey of
USSR Air Pollution Literature. Effects and
Symptoms of Air Pollutes on Vegetation;
Resistance and Susceptibility of Different Plant
Species in Various Habitats, In Relation to Plant
Utilization for Shelter Belts and as Biological
Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver
Spring, Md., American Institute of Crop Ecology,
1969, p. 44-49. 11 refs. (Also: Tr. Inst. Ekologii
Rasteniy Zhivotnykh, Akad. Nauk SSSR Ural.
Filial. (Sverdlovsk), vol. 54:85-89, 1967.)
V. S. Nikolaevskiy.
Identifiers: *Trees, *Toxic tolerances, *Combustion gases, Leaves, Plant damage, Adaptation, Ussr, Sulfur dioxide.

In the planting of trees around industrial centers and cities in the Central Urals with a significant amount of acid gas pollution, a wider use is made of introduced species, as compared with the use of local species. This is because the introduced species are more ornamental and also more gas resistant. The relatively high gas resistance of a number of introduced species is explained by their higher plasticity and adaptability to new ecological conditions. Six groups were isolated on the basis of gas resistance by a study of the physiological-biochemical characteristics of trees and the anatomicalmorphological structure of their leaves. The recommended gas-resistant species are box elder, red-berried elder, spindle tree, snowberry, silverberry, oleaster, elm, pubescent lilac, and Canadian poplar. From the native species, only Tartar honeysuckle and sallow willow can be used. (Author conclusions modified)
APTIC-22495

### ASSORTMENTS OF GAS-RESISTANT LAWN GRASSES.

In: American Institute of Crop Ecology Survey of
USSR Air Pollution Literature. Effects and
Symptoms of Air Pollutes on Vegetation;
Resistance and Susceptibility of Different Plant
Species in Various Habitats, In Relation to Plant
Utilization for Shelter Belts and as Biological
Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver
Spring, Md., American Institute of Crop Ecology,
1969, p. 50-55. (Also: Tr. Inst. Ekologii Rasteniy
Zhivotnyhk (Sverdlovsk), vol. 54:91-95, 1967.)
E. N. Kazantseva.
Identifiers: *Grasses, *Toxic tolerances, *Fluorine compounds, Mottling, Tip burn, Photosynthesis, Metabolism, Aluminum, Ussr, Primary metallurgical processing, Water.

Investigations concerning the gas resistance of lawn grasses were conducted at a Ural aluminum plant where fluorine pollution is present. Photosynthesis and the water regimen were studied in meadow fescue, red fescue, Kentucky bluegrass, red top, and timothy grass. Damage was observed in early spring when the leaves were appearing. There was burn on the tips of the leaves; then spotting and blotching appeared. The damage increased and reached a peak toward the end of the growing season. The smallest percentage of damage was observed on meadow fescue, red fescue, and Kentucky bluegrass, while the greatest damage was found on red top and timothy grass. Fluorine compounds decreased photosynthesis, water-holding capacity, and the quantity of free water. Slightly damaged species have a lower photosynthetic intensity, greater water-holding capacity, and more free water than the severely damaged grasses. Meadow fescue, red fescue, and Kentucky bluegrass are recommended for industrial sectors with severe fluorine pollution. Red top, 'regneria', Awnless bromegrass, and timothy grass are suggested for sectors with little pollution.
APTIC-22496

### TYLOSIS FORMATION IN RESPONSE TO FLUORIDE FUMIGATION OF LEAVES.

Phytopathology, vol. 59:518-519, April 1969. 6
refs.
B. W. Poovaiah, and H. H. Wiebe.
Identifiers: *Tylosis, *Hydrofluoric acid, Flowers, Plant damage.

Occurrence of tyloses in the petiole of geranium plants fumigated with fluoride gives evidence that injury may influence function of tissues some distance from the actual site of visible damage. In the early stages of hydrogen fluoride fumigation, light-brown colored areas appeared at thzeee white margins of leaves; these beco necrotic zones as the fumigation was prolonged. Intermediate-age leaves were injured more severely than either younger or older leaves. All tissues were affected in severely injured edges, although some upper epidermal cells still appeared nearly normal. In the zone adjacent to the severely injured area, the upper half of the leaf was normal, while the spongy mesophyll cells became plasmolyzed and collapsed. Distortion of chloroplasts and starch grains was noted in parenchyma cells near the injured area. Severely injured and necrotic regions stained very heavily with safranin. The first occurrence of injury in the spongy mesophyll is consistent with the suggestion that fluoride enters mainly through the stomata. Fluoride effects are more evident in the vascular region than other areas, and it is possible that the fluoride damage produces early senescence that in turn causes the tyloses to form. In the phloem, cylinder-like depositions were noted on sieve plates which were identified as callose by strong fluorescence when stained with aniline blue and illuminated with ultraviolet light.
APTIC-22499

### THE EFFECT OF SULFUR DIOXIDE ON CONIFERS.

Proc. U. S. Tech. Conf. Air Pollution, 1952, Chapt.
8, p. 84-96. 24 refs.
Morris Katz, and A. W. McCallum.
Identifiers: *Conifers, *Toxic tolerances, *Sulfur dioxide, Seasonal, Trees, Plant damage, Plant growth, Canada, Fumes, Primary metallurgical processing.

Fumigation studies were undertaken to determine the effect of smelter fumes on a natural stand of Douglas fir and yellow pine and also on transported conifers. Trees in the natural stand were 25-30 years old, while the transplanted conifers were 3-10 years old. In addition, seedlings of yellow pine and Douglas fir from 1-3 years old were exposed to varying concentrations of sulfur dioxide. The conifers in their natural habitat were much more susceptible to sulfur dioxide in spring and early summer than in autumn and winter. The susceptibility paralleled the seasonal variations in physiologic activity of the leaves. The transplanted conifers were more susceptible to sulfur dioxide than trees in the natural stand, but the former were also extremely resistant during the period of the year when there was a virtual cessation in growth. Severely injured trees exhibited reduced growth for about three years following exposure, after which there was a substantial recovery. Seedlings were more susceptible than the older trees. The susceptibility of the species investigated, arranged in order of increasing resistance, was as follows: larch, Douglas fir, Engelmann spruce, white pine, yellow pine, cedar, lodgepole pine, silver fir, and white fir. Two forms of injury were recognized: acute and chronic. However, no evidence was found to support the theory of 'invisible injury.' When high concentrations were not present, the fumigations were without toxic effects. It is concluded that sulfur dioxide will not injure vegetation if ground concentrations higher than 0.3-0.5 ppm do not occur.
APTIC-22570

### MOISTURE CONDITIONS AND GAS RESISTANCE OF WOODY PLANTS.

In: American Institute of Crop Ecology Survey of
USSR Air Pollution Literature. Effects and
Symptoms of Air Pollutes on Vegetation;
Resistance and Susceptibility of Different Plant
Species in Various Habitats, In Relation to Plant
Utilization for Shelter Belts and as Biological

Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver Spring, Md., American Institute of Crop Ecology, 1969, p. 41-43. 4 refs. (Also: Akad. Nauk SSSR Ural. Filial. Komis. po Okhrane Prirody. Rastitel' nost' i promyshlennye zagryazneniya. Okhrana prirody na Urale. V (Sverdlovsk, 1966) p. 49-51.)
Yu. Z. Kulagin.
Identifiers: *Trees, *Toxic tolerances, *Gases, *Water, Leaves, Plant damage, Cell metabolism, Toxicity, Ussr, Sulfur dioxide

The relationship between water conditions of woody plants and their gas resistance is important in selecting gas-resistant species on the basis of the specific water conditions and degree of drought resistance. There is an opinion that drought-resistant trees are also gas-resistant. A number of species differing in their degrees of drought resistance and the nature of water conditions were studied. The gas resistance of the leaves of the selected species varies. Sulfur dioxide damaged larch needles 100%; pea tree leaves, 80%; European white birch leaves, 50%; and pubescent birch leaves, 70%. Thus, the larch and pea tree, although most drought-resistant, are least gas-resistant. Not all drought-resistant species are also gas-resistant. The only resistant species are those whose leaves have a xeromorphic structure. Toxic gases, when injuring susceptible trees, affect the water conditions of the leaves by lowering the bound water content and their water retention capacity, and thus, their drought resistance.
APTIC-22572

## SMOKE RESISTANCE OF WOODY PLANTS AS AN ECOLOGICAL PROBLEM.

In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Effects and Symptoms of Air Pollutes on Vegetation; Resistance and Susceptibility of Different Plant Species in Various Habitats, In Relation to Plant Utilization for Shelter Belts and as Biological Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver Spring, Md., American Institute of Crop Ecology, 1969, p. 32-34. 2 refs. (Also: Akad. Nauk SSSR. Ural. Filial. Komis. po Okhrane Prirody. Rastitel' nost' i promyshlennye zagryazneniya. Okhrana prirody na Urale. V (Sverdlovsk, 1966), p. 25-27.)
Yu. Z. Kulagin.
Identifiers: *Trees, *Toxicity, *Smoke, Seasonal, Leaves, Plant damage, Toxic tolerances, Ussr, Dusts, Smokes, Petroleum refining, Primary metallurgical processing, Magnesium compounds, Oxides, Sulfur dioxide.

The ecological factor of smoke resistance in woody plants was the basis of investigations in areas surrounding metallurgical and petroleum refineries. Conditions of smoke pollution should be distinguished by considering the physicochemical properties of the toxic components of the smoke, the intensity of gas and dust effects, the frequency of their occurrence during the growing period, and their annual recurrence. This ecological concept requires a recognition of the critical periods when the sensitivity to toxic components is greatest. The critical periods are connected with weak morphological defense of tender shoots; inability to regenerate leaves; and injury followed by unfavorable weather conditions. The critical period for conifers dusted with magnesium oxide is early summer, when the needles are being formed. A sulfur dioxide attack in early or midsummer is lethal for pine, spruce, lilac, and other species with a weak leaf regeneration capacity. A late summer exposure to SO2 is not injurious. Smoke from industrial plants should be considered as an ecological factor. The degree of toxicity of industrial gases depends greatly on the surrounding atmospheric conditions. The survival and regeneration of tree is determined by the maturity of the shoots and their resistance to the subsequent weather conditions.
APTIC-22585

## PHYSIOLOGICAL EFFECTS OF ETHYLENE AND OTHER UNSATURATED CARBON-CONTAINING GASES.

In: Growth of Plants, New York, Reinhold Publishing Corp., 1948, Chapt. 4, p. 139-171. 73 refs.
William Crocker.
Identifiers: *Plants (botany), *Metabolism, *Ethylene, Sweet peas, Fruits, Leaves, Tomatoes, Plant growth, Plant indicators, Cell growth, Thresholds, Acetylenes, Carbon monoxide.

The effects of ethylene, acetylene, propylene, and carbon monoxide on plant development and metabolism were studied. Qualitatively, the four gases act similarly on plants; each produces the response that any other produces provided they are used in the proper concentrations. Quantitatively, they are different; the minimum effective concentration of ethylene is lower than that of acetylene and propylene, and the effective concentration of CO is higher than that of the last two. Ethylene modifies the geotropic equilibrium position of plant organs, causing declination or horizontal nutation of pea seedlings, leaf abscission, and change in root orientation. With a sensitive variety of sweet pea, using declination as the indicator, ethylene concentrations of 0.2 ppm can be detected. Using leaf epinasty of the tomato, 0.1 ppm ethylene can be detected. Leaf epinasty of the African marigold is the most sensitive test known for ethylene; it will detect 0.001 ppm ethylene in air. Ethylene causes dormant cells to enlarge and divide, forming soft, massive tissues. It induces the abscission of leaves, flowers, petals, and fruits by causing the flat cells of the abscission layer to enlarge and become spherical. Ethylene induces the decomposition of chlorophyll and is used to hasten the proper coloring of ripe citrus fruits and to bleach celery. It induces many other metabolic changes which are mainly hydrolytic, such as transformations of insoluble protopectins to soluble pectins, higher carbohydrates to soluble sugars, and proteins to polypeptides and amino acids.
APTIC-22612

## ON THE EFFECT OF A LABORATORY ATMOSPHERE ON THE GROWTH OF POTATO SPROUTS.

(Uber den Einfluss der Laboratoriumsluft auf das Wachstum Kartoffelsprosse). Ber. Duet. Botan. Ges., vol. 21:175-180, 1903. 3 refs. Translated from German. Belov and Associates, Denver, Colo., 9p., June 2, 1970.
Maximilian Singer.
Identifiers: *Plant growth, *Coal, *Fuel gases, Potatoes, Czechoslovakia, Controlled atmospheres.

The growth of potato sprouts under the influence of a laboratory atmosphere in which coal gas was present was investigated. When a potato shoot approximately 7 cm high and several smaller shoots which were grown in a greenhouse under a bell jar, were placed in a laboratory room, the shoots twisted from a vertical to a horizontal direction. If potatoes were brought into the laboratory and covered with a layer of water, they continued to grow in a vertical direction. It was confirmed that the twisting of the shoots was not due to heliotropism, humidity, or hydrotropism; the reason for the twisting was the effect of the impure laboratory atmosphere which contained coal gas. A coal gas concentration of 0.1% induces twisting and thickening in the potato sprouts. If the concentration is reduced to 0.002%, no twisting of the main sprout is produced.
APTIC-22619

## THE ABSORPTION OF SULPHUR DIOXIDE BY SPRUCE AND PINE TREES.

(Naturwissenschaften (Berlin), 50 (11):407, 1963. 1 ref. Translated from German. Belov and Associates, Denver, Colo., 2p., Dec. 30, 1969.
Jan Materna, and Rudolf Kohout.
Identifiers: *Trees, *Absorption, *Sulfur dioxide, Seasonal, Leaves, Plant damage, Czechoslovakia, Isotopes, Radioactive tracers.

During an investigation of the composition of spruce and pine needles in stands damaged by smoke, the sulfur content of the needles increased in the winter. Part of this accumulation can be explained by the weight loss that occurs in winter and the relative accumulation of the content material that this causes; in heavily damaged trees the increase is so large that this explantaion is insufficient. Investigations were conducted to determine if sulfur dioxide was assimilated by the needles during winter. Marked sulfur dioxide, SO2 (35), was used for this purpose. In 15 to 25 year old, healthy, free-standing spruce and pine trees, a well developed branch was wrapped in a polyethylene bag. An ampule of SO2 was crushed in the bag producing a concentration of 8-10 mg SO2/cu m of air. Needle samples were taken after 24 hours and at regular intervals. The results showed that the needles of the treated branch absorbed almost the entire quantity of SO2. A small amount of the sulfur was transported to ungassed needles in other parts of the crown, but it was intensively stored in needles of newly formed shoots. Similar experiments showed that SO2 is also absorbed at night.
APTIC-22621

## INVESTIGATIONS OF SMOKE GAS DAMAGES TO VEGETATION.

(Untersuchunge uber die Rauchgasschaden der Vegetation). Z. Angew. Chem. (Weinheim), vol. 42:123-126, Jan. 3, 1929. 6 refs. Translated from German. Belov and Associates, Denver, Colo., 12p., May 27, 1970.
Kurt Noack.
Identifiers: *Plant damage, *Smokes, *Reaction mechanisms, Clover, Corn, Tobacco, Spinach, Photosynthesis, Chloroplasts, Metabolism, Germany, Hydrochloric acid, Nitric acid, Nitrous acid, Ammonia, Iron compounds, Photooxidation, Light radiation.

Investigations were conducted to determine if nitrous gas, hydrochloric acid, and ammonia cause plant damage similar to that caused by sulfur dioxide, and to determine the participation of the iron contained in chloroplasts in this disease process. The assimilation apparatus in the moss fontinalis was primarily affected by nitrous gas and these effects corresponded to the effect of SO2; HCl had a lesser effect, and ammonia was not considered to be an assimilation poison. Clover, tobacco, and spinach plants exposed to nitrous gas became withered and bleached with inhibited assimilation after exposure to light. Plant damage by SO2 and nitrous gas consists of a fixation of iron followed by a photooxidative poisoning of the protoplasm by chlorophyll. Tests on corn were conducted to determine if the water soluble part of iron increases after introducing assimilation poisons. Pre-treatment with fuming nitric acid resulted in a water soluble iron content four times higher than normal. The effect of smoke gases on plants consists of a direct cancellation of the catalytic activity of the iron in the chloroplasts. The photooxidative poisoning of the protoplasm is considered to be a secondary effect.
APTIC-22622

## INVESTIGATIONS OF THE UPTAKE OF FLUORINE BY PLANTS FROM THE SOIL.

(Untersuchungen uber die Aufnahme von Fluor aus dem Boden Durch Pflanzen). Qualitas Plant. Mater. Vegetabiles, vol. 14:223-236, 1967. 9 refs. Translated from German. Belov and Associates, Denver, Colo., 24p., May 30, 1970.
K. Garber, R. Guderian, and H. Stratmann.
Identifiers: *Plant damage, *Soils, *Fluorine, Oats, Leaves, Potatoes, Tomatoes, Necrosis, Plant growth, Germany, Absorption, Fluorides.

Experiments were conducted with different soil types to determine the fluorine uptake by plants

from the soil. Indentical plant species showed different fluorine contents on different soils, and there was no correlation between the F-values in the soils. Additions of sodium and calcium fluoride of 5 mg F per 100 g soil (F mg%) to the soil had no effect on the F-level of the plants. Some one year old plants indicated necrosis and discoloration, especially at the leaf tips, and a decrease in yield which was stronger for soil with $CaF_2$-additions. The uptake of fluorine, necrosis, discoloration, and decreased yield were more pronounced on sandy soil than on marshy or clay soils. Equal amounts of fluoride when added in one portion had a more damaging effect on the growth of Tradescantia and tomato than when added in three partial portions. The addition of NaF to oats in one portion before seeding had no effect on the F-content, but experiments with gradual additions showed a strong increase of the F-value. Soils taken from regions with flourine emissions were used to grow beans. The increased F-level in the beans is considered as proof that fluorine emissions act directly on the plant parts above the soil, and indirectly through the soil. (Author summary modified)
APTIC-22624

### CONTRIBUTION TO THE BIOCHEMICAL FUNDAMENTALS OF HARTEL TURBIDITY TEST.

(Prispevek k poznani biochemickych zakladu Hartelova zakaloveho testu). Lesnictvi, 7 (4):389-400, 1961. 15 refs. Translated from Czech.
Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 22p., Nov. 4, 1969.
Jan Materna, and Ludmila Ryskova.
Identifiers: *Spruces, *Turbidimetry, *Smokes, Trees, Plant damage, Czechoslovakia, Ashes, Calcium compounds, Iron compounds, Magnesium compounds, Potassium compounds, Nitrates, Sulfur compounds.

An extract from spruce needles was analyzed to characterize in detail the substances causing turbidity of the extract. The extract contained a number of mineral substances such as calcium, magnesium, potassium, silicon, iron, phosphorus, and sulfur. The organic substances present were tannides, carbohydrates, nitrates, pektins, polysaccharides, and substances soluble in ether. During the extraction of needles injured by smoke, the extract received all these substances in higher amounts than when processing healthy needles. A correlation was established between the amount of extracted sulfur and ashes and light absorption by the extract. Increased extraction of tannides from the smoke-damaged needles can be utilized as a new qualitative test to determine the effect of smoke on spruces. The turbidity itself is formed by a mixture of compounds comprising ashes, ether extractable substances, polysaccharides, proteins, traces of pektins, polyphenols, and dyes. The Hartel turbidity test is a simple method for determining the effect of smoke on spruce and delineating the area under attack. The test was analyzed in detail, its nature partially elucidated, and another simple method worked out for orientational determination of the effect of smoke on the assimilation organs of spruce. This test is based on the different degrees of extractability of tannides from healthy needles and from needles exposed to sulfur dioxide. The test requires no special laboratory equipment. (Author conclusions)
APTIC-22626

### AIR POLLUTION AFFECTS PATTERN OF PHOTOSYNTHESIS IN PARMELIA SULCATA, A CORTICOLOUS LICHEN.

Science, vol. 148:1600-1602, June 18, 1965. 7 refs.
Lorentz Pearson, and Erik Skye.
Identifiers: *Lichens, *Sulfur dioxide, Plant damage, Photosynthesis, Sweden, Urban areas, Fungi.

Lichen disks kept in flasks contaminated with sulfur dioxide showed morphologic and photosynthetic abnormalities similar to those of lichens from an industrial center in Sweden, but lichens dried out for four and one-half to six months showed neither. Thallus lobes of the lichens collected from the air-polluted sites, especially from Slottsbacken near the center of Uppsala, were pale in color, frequently discolored pink, and neither as thick nor as succulent as the lobes of the normal lichens. As the light intensity was increased from 0 to 80 volts, apparent photosynthesis increased from -4 to -2 ml of 02 per hr in the lichen disks rated 3, 4, or 5, remained about the same in the disks rated 2, and decreased in the poorest disk, rated 1. With heavy contamination (1, 5, or 10% $SO_2$) the lobes of artificially exposed lichens became very pale in color, sometimes showed a pink discoloration, appeared dried, and carried out net respiration at all light intensities. Thus, some kinds of lichens may be absent from city environments because of atmospheric pollutants which destroy chlorophyll. (Author abstract modified)
APTIC-22677

### A STUDY OF REACTIONS IN LOS ANGELES SMOG. (FINAL REPORT).

Stanford Research Inst., Calif., SRI Proj. C-1120, Rept. 3, 123p., Aug. 1, 1955. 5 refs.
Leon J. DeMerre.
Identifiers: *Plant damage, *Eye irritation, *Los angeles, *Smog, Lettuce, Pinto beans, Spinach, Toxic tolerances, Oxidants, Gasolines, Visibility, Filters, Simulation, Irradiation chambers, Nitrogen oxides, Nitrogen dioxide (no2), Ozone, Chemical reactions, Photochemical reactions, Solar radiation.

Generated smogs were studied and their properties determined by the following criteria: plant damage, eye irritation, reduction in visibility, and oxidant concentration. A chamber was constructed in which the average light intensity was made to approximate midday sun. The chamber was about 500 cu ft in volume and was so constructed that the residence time for a parcel of air passing through it could be varied from a few minutes to two hours. Night air was irradiated in the chamber and passed into a smaller fumigation chamber in which the number of plants and their positions were dictated by statistical considerations. Phytotoxic substances were produced in the night air by irradiation, as proved by the subsequent markings obtained on the plants. In addition, these markings were identical to those observed in the field after a natural smog attack. Among the species used, Romaine lettuce gave very reliable markings and Poa annua and Pinto beans typical smog damage, whereas spinach exhibited no characteristic damage. On adding 5 ppm gasoline to night air and irradiating the mixture, heavy plant damage was obtained. No damage was detected using 1-hexene. Plants grown in the greenhouse receiving carbon-filtered air remained undamaged on smoggy days. Carbon-filtered air is not necessarily free from contamination; however, certain phytotoxic substances were reduced below the threshold of plant damage. When 20-40 pphm ozone was added to carbon-filtered air, the resultant marking was not very different from smog damage. Sixty pphm ozone resulted in death of the leaves in less than two hours. The results of eye irritation tests showed a trend toward an increasing irritation from mixtures going from carbon-filtered air to night air to irradiated night air. There was a higher level of oxidizing compounds at the outlet of the irradiation chamber than at the inlet. Increases in nitrogen oxides levels were observed when the ozone stream was flowing. The level of nitrogen dioxide without ozone varied between 1 and 5 pphm. During ozonization of the air stream, the levels of combined oxides went as high as 20 pphm. The hazemeter selected to investigate any decrease in visibility was too insensitive for the particular situation; otherwise, all tests performed supported the premise that smog is formed by the irradiation of night air and as the result of a photochemical reaction. (Author summary modified)
APTIC-22759

### HOW PLANTS TEST AIR.

Org. Gardening Farming, 1961:71-78, March 1961.
Charles H. Coleman.
Identifiers: *Plant damage, *Plant indicators, Economic losses, Oxidants, Smog, Herbicides, Monitoring, Fluorides, Ethylene, Sulfur dioxide, Ozone.

Although laboratory tests tell when phytotoxicants are present in the atmosphere, only plants will tell when they combine to form fog-burn contaminant injurious to crops. Moreover, in many instances, plants provide the first warning of early air pollution. The reliance scientists place on plant indicators is exemplified by a San Francisco program in which plant data is fed into electronic machines to determine the extent and origin of pollution damage. Plants susceptible to air pollution are listed and the effects of oxidants, ozone, fluorides, sulfur dioxide, ethylene, smog, and herbicides on plants are summarized. It is noted that air pollution damage to crops is $7 1/2 billion per year and that plants will become increasingly important for monitoring pollutants.
APTIC-22789

### THE INFLUENCE OF OZONE ON CONIFERS.

Pennsylvania State Univ., University Park, Center for Air Environment Studies, NAPCA Grant AP 00436, Fellowship 5F3 AP 33,925, Pub. 158-70, 95p., March 1970. 32 refs.
Donald D. Davis.
Identifiers: *Ozone, *Trees, *Plant damage, Mottling, Necrosis, Tip burn, Thresholds, Humidity, Temperature (atmospheric).

The relative susceptibility of coniferous species commonly found in the northeastern United States to ozone is investigated. The influence of plant and needle age and environmental factors on the sensitivity of a species to ozone is explored. Needles are injured by 25 pphm 03 for 2 hr; they reach maximum sensitivity at 3-5 weeks of age, and become resistant at 16 weeks. The relationship of relative humidity, temperature, and light exposure to injury is determined. Young needles are injured most severely at the tips, while older ones show most injury at the base. Chlorotic mottle and tip or needle necrosis are the most common symptoms on the secondary needles of the various conifers. It is important that the influence of 03 on plants be considered in the establishment of air quality standards.
APTIC-22813

### THE EFFECT OF ATMOSPHERIC FLUORIDE ON WASHINGTON AGRICULTURE.

In: Air Pollution. Louis C. McCabe (ed.), New York, McGraw-Hill Book Co., Inc., 1952, Chapt 11, p. 116-122. 7 refs.
Vernon L. Miller.
Identifiers: *Plant damage, *Fluorides, Cattle, Gladioli, Leaves, Trees, Plant indicators, Fluorosis, Washington (state).

A variety of studies on fluorides and vegetation are briefly reported. A new disease of the gladiolus Italian prune, characterized by brown, marginal leaf scorch and premature defoliation, is caused by industrial fluoride emissions. Fluorine scorch of gladiolus may be controlled by lime sprays under field conditions, and early results suggest that some varieties of gladiolus may serve as indicator plants in areas where fluoric effluents are a factor. Fluorosis of cattle in Washington was diagnosed, caused by ingestion of forage containing fluoride from air pollution. Extensive research is in progress on a number of possible causes of the ponderosa pine blight, including air pollution, climatic factors, insect damage, and fungus diseases; conclusive results are not yet available.
APTIC-22887

### TRYPTOPHAN-INDUCED INTERSTITIAL PULMONARY EMPHYSEMA IN CATTLE.

J. Vet. Res., 29 (10):1983-1989, Oct. 1968. 15 refs.
J. R. Carlson, I. A. Dyer, and R. J. Johnson.

Identifiers: *Tryptophan, *Cattle, *Emphysema, Amino acids, Metabolism.

Oral administration of d,1-tryptophan (0.7 gm/kg) to cows caused interstitial pulmonary emphysema one and a half to four and a half days after treatment. The concentration of tryptophan in plasma of cows increased after tryptophan was administered, but apparently was not directly responsible for development of the syndrome. Similar levels of tryptophan in plasma were produced in cattle by intraperitoneal injection and by infusion, but these cattle did not develop interstitial pulmonary emphysema. The evidence indicates that a product of ruminal metabolism such as a tryptophan metabolite may be the causative factor in interstitial pulmonary emphysema of tryptophan-treated cattle. Sheep did not develop interstitial pulmonary emphysema when treated in a manner identical with that which caused severe pulmonary lesions in cattle. The concentration of tryptophan in plasma of cattle and sheep was similar after they were given an oral dose of d,1-tryptophan. These results suggest that the tryptophan-induced syndrome may be species-specifc and that a difference in tryptophan metabolism may exist between cattle and sheep. (Author abstract modified)
APTIC-23352

### EFFECT OF SULFUR DIOXIDE ON THE ENZYMATIC ACTIVITY OF TREE LEAVES.

In: American Institute of Crop Ecology Survey of
USSR Air Pollution Literature. Vol. III. The
Susceptibility or Resistance to Gas and Smoke of
Various Arboreal Species Grown Under Diverse
Environmental Conditions in a Number of
Industrial Regions of the Soviet Union. M. Y.
Nuttonson (ed.), Silver Spring, Md., American
Institute of Crop Ecology 1970, p. 109-114. 17 refs.
Translated from Russian (Also: Okhrana Prirody
na Urale., vol. 5:19-23, 1966.)
V. S. Nikolaevskiy.
Identifiers: *Plant damage, *Enzymes, *Sulfur dioxide, Trees, Photosynethsis, Ussr, Oxidation, Photooxidation, Reduction.

Data are presented on changes in catalase, polyphenol oxidase, and peroxidase activity in leaves of ash-leaved maples and European white birch exposed to small and high concentrations of sulfur dioxide. The difference in enzyme activity in the two species confirm the assumption that the intensity of photodynamic oxidation under the influence of sulfur dioxide and light is proportional to the oxidation-reduction activity of enzyme systems in plants. Maples are characterized by a lower intensity of gas exchange and enzyme activity, and consequently by a lower vulnerability. Catalase activity clearly decreased under the influence of even small sulfur dioxide concentrations. The decrease is likely to contribute to an increase in oxidation processes and to plant damage.
APTIC-23400

### PROSPECTS FOR BREEDING ORNAMENTAL SCOTCH PINES RESISTANT TO AIR POLLUTANTS.

Dept. of Agriculture, St. Paul, Minn., North
Central Forest Experiment Station and Southern
Illinois Univ., Carbondale, Dept. of Forestry.
Proc. Central States Forest Tree Improvement
Conf. 6th, Carbondale, Ill. and St. Louis, Mo.,
1968, p. 34-36. 26 refs. (Oct. 16-18) CFSTI: PB
191131
Henry D. Gerhold, and Edgar H. Palpant.
Identifiers: *Scotch pine, Trees, Sulfur dioxide, Ozone.

A project is underway to develop methods of breeding ornamental trees with a genetically superior resistance to sulfur dioxide and ozone. Major attention will be focused on Scotch pine since the species is adaptable to a wide variety of sites and conditions over a wide variety of latitudes. Moreover, Scotch pine already has moderate resistance and the internal variability needed as the basis for further improvement. Breeding can be done conveniently in young, flowering plantations that contain an extensive collection of provenances representing most of the genetic diversity within the species. Important elements of the long-range plan are to find the best sources of resistance, to select intensively for the most desirable individuals at an early age, to find and use the breeding method that will produce an optimum combination of characteristics in the least time, and to develop a method for rapid multiplication of trees that have immediate usefulness. Two methods of selection, to be used in tandem, will be investigated. Two-yr-old seedlings will be fumigated under carefully controlled conditions in the nursery. Then survivors will be planted near pollutant sources for exposure under field conditions. After four growing seasons, evaluations of resistance and other traits will be completed. At this age the potential for rooting of cuttings is still high, and the next generation in the breeding program can be started within a few years.
APTIC-23403

### AGRICULTURE AND AIR POLLUTION.

California Air Environ., 1 (6):1-3, April-June,
1970.
O. Clifton Taylor.
Identifiers: *Plant damage, Economic losses, Synergism, California, Ethylene, Peroxyacetyl nitrate, Nitrogen dioxide (no2), Ozone, Photochemical reactions.

Air pollution damage to vegetation in California over the last two decades is conservatively estimated at $44,000,000. Most of the damage is due to the secondary pollutants produced by photochemical reactions in polluted atmospheres: nitrogen dioxide, ozone, and peroxyacetyl nitrate (PAN). With the exception of ethylene, the primary pollutants are relatively nontoxic to vegetation. Sensitive plants exposed for one hour or more may be visibly injured when nitrogen dioxide concentrations exceed 6 ppm; ozone, 5 pphm; and PAN, 10 ppb. Ozone enters through stomatal openings on leaves and attacks mature leaf tissue rich in green chlorophyll pigment. On highly sensitive plants, 'bifacial' necrotic spots extend completely through the leaf tissue. More subtle symptoms of ozone injury are bleaching of leaves, red pigmentation, chlorosis, premature abscission of leaves, and growth suppression. Severe injury from PAN on highly sensitive plant tissues is usually represented by complete collapse of tissue in a transverse band across some portion of the leaf. Less definite symptoms include growth suppression and abscission of plant parts. Ethylene from external sources can cause growth retardation, downward curvature of shoots and leaf petioles, abscission of leaves and flowers, irregular opening of flowers, and abnormal floral tissue. Experiments with synthesized toxicants have shown that injury produced by a mixture of pollutants may be more severe than the added effect of two toxicants used separately. This synergistic effect, and the possible interaction with other environmental factors, may make a particular toxicant a greater threat in one locality than in another.
APTIC-23420

### HEAVY METALS WITHIN THE REGION OF VARGO-TROLLHATTAN.

(Tungmetallfororeningar inom Vargon-
Trollhattanomradet). Text in Swedish. Lund Univ.
(Sweden), Inst. of Ecological Botany, Rept. 14,
22p., April 1970.
Ake Ruhling
Identifiers: *Metal compounds, *Mosses, *Plant indicators, *Sweden, Plants (botany), Primary metallurgical processing, Air quality measurements, Cadmium compounds, Chromium compounds, Cobalt compounds, Copper compounds, Iron compounds, Lead compounds, Manganese compounds, Molybdenum compounds, Vanadium compounds, Nickel compounds, Zinc compounds.

Measurements of heavy metals were made within a region where heavy industry is situated. A common sort of moss, Hypnum cupressiforme, was analyzed at 127 sites for lead, iron, cadmium, cobalt, copper, chromium, manganese, molybdenum, nickel, vanadium, and zinc. The mosses were at least 100 m from any road to prevent the possibility of automotive contamination. In general, very high values of metals were observed in the mosses. For example, in the region of a ferro-alloy plant, concentrations as high as 12,000 ppm of chromium and 30,000 ppm of manganese were found. The normal values for Sweden are 10 and 200 ppm respectively.
APTIC-23435

### HEAVY METALS IN THE REGION OF VARGON-TROLLHATTAN. II. ARSENIC AND MERCURY.

(Tungematallfororeningar inom Vargon-
Trollhattanomradet. II. Arsenik, Kvicksilver).
Text in Swedish. Lund Univ. (Sweden), Inst. of
Ecological Botany, Rept. 15, 8p., May 1970.
Ake Ruhling.
Identifiers: *Arsenic compounds, *Mercury compounds, *Mosses, *Plant indicators, Plants (botany), Steel, Sweden, Streets, Industrial areas, Primary metallurgical processing, Air quality measurements.

Arsenic and mercury were measured in a common moss, Hypnum cupressiforme, in the region of Vargon-Trollhattan, Sweden. Three samples were taken from each of 127 sites, all more than 100 m from any road. The region studied is highly industrialized with iron, steel, and ferro-alloy industries. No exceptionally high values were observed.
APTIC-23436

### HEAVY METALS IN THE REGION OF THE TOWN OF OSKARSHAMN. III. ARSENIC SNOW ANALYSIS.

(Tungmetallfororeningar inom
Oskarshamnsomradet. III. Arsenik, snoanalyser).
Text in Swedish. Lund Univ., (Sweden), Inst. of
Ecological Botany, Rept. 13, 7p., March 1970.
Ake Ruhling.
Identifiers: *Oskarshamn, *Mosses, *Plant indicators, *Arsenic compounds, Plants (botany), Sweden, Urban areas, Air quality measurements, Snow.

The results of measurements of arsenic and heavy metals around the town of Oskarshamn, Sweden are discussed. Samples of a common moss, Hypnum cupressiforme, were taken at 36 sites and analyzed. Very high arsenic levels were observed in the region. In general, values lower than 0.5 ppm are observed in Sweden, but in the center of the town values of 100 ppm were found. The town as a whole showed values not lower than 2.5 ppm.
APTIC-23442

### THE ROLE OF 3,4-BENZOPYRENE IN THE GROWTH OF PLANTS.

(3,4-Benzpyren als Wachstrumsfaktor bei
pflanzen). Text in German. Arch. Hyg. Bakteriol.
(Munich), vol. 148:489-492, 1964. 11 refs.
Walter Graef.
Identifiers: *Vegetables, *Absorption, *Benzo (3-4)pyrene, Fruits, Retention, Carcinogens, Germany, Soils.

The possibility of absorption and accumulation of cancerogenic hydrocarbons from soil by culture plants was studied. Plants important for human nourishment were grown on soil as well as in hydrocultures fertilized by 3,4-benzopyrene acid materials containing it. The content of benzopyrene in ripe plants or its fruits was compared with results of unfertilized control plants. Benzopyrene water solution was prepared from its acetone solution in maximum achievable concentration of 10 grams per liter of water. The solution was characterized by intense blue-violet fluorescence. Lettuce, cauliflower, turnips, and

other plants were grown in hydrocultures with 10 grams of benzopyrene per liter and on soil cultures watered daily by benzopyrene solution in distilled water of the same concentration. Benzopyrene disappeared from nutrients hydroculture solutions within 8 days, plus indicating its absorption of plants. Acceleration in growth of turnips in fertilized hydrocultures and soil was observed in comparison with control plants.
APTIC-23457

### NEW TECHNIQUE AIDS STUDY OF SMOG EFFECTS ON CITRUS PLANTS.

Chem. Eng. News, 39 (8):42-43, Feb. 20, 1961.
Personal Author Not Recorded.
Identifiers: *Experimental methods, *Oxidants, *Smog, Citrus, Trees, Plant damage, Controlled atmospheres, Exposure methods, Simulation, Exposure chambers, Fluorides, Peroxyacyl nitrates, Nitric oxide (no), Ozone, Hydrogen sulfide, Chemical reactions.

A technique for removing oxidants from smog without affecting the concentration of fluorides was developed for use in a long-term study of smog damage to citrus trees. The technique is based on the gas-phase reaction between oxidants and nitric oxide, which removes virtually all the ozone though not all the peroxyacyl nitrates. The oxidants are first mixed with filtered room air and fluoride, then with the reductant in a large polyethylene reaction chamber. If desired, hydrogen sulfide can be added to air leaving the chamber to promote further oxidant removal. Effluent from the chamber is divided between a fluoride recorder and an oxidant recorder. The possibility that hydrogen sulfide might protect plant leaves from oxidants is noted.
APTIC-23516

### OBSERVATIONS ON THE SENSITIVITY TO FLUORINATED GASES OF SOME PLANT SPECIES OF VALAIS.

(Observations sur la sensibilite aux gaz fluores de quelques especes vegetales du Valais).
Phytopathol. Z., vol. 53:290-298, 1965. 11 refs.
Translated from French. Belov and Associates, Denver, Colo., 17p., June 18, 1970.
A. Bolay, and E. Bovay.
Identifiers: *Fluorine compounds, *Trees, *Necrosis, Leaves, Plant indicators, Thresholds, Toxicity, Toxic tolerances, Europe.

Observations made over a period of 15 years on the relative sensitivity of various plants to fluorine compounds are reported. The three methods used in evaluating damage to plants are: observation of typical necroses appearing on the foliage, chemical analyses of the fluorine content of the plants, and utilization of certain indicator species to detect fluorine. Examinations of tree leaves permit the establishment of sensitivity limits. No injury occurs below 25 ppm, variable reactions occur from 25-105 ppm, depending on the climate and health of the plants, and burns are almost always present from 105 ppm on. Plant species are separated into 4 classes based on their sensitivity. The most sensitive plants can be used as indicators of the presence of fluorine, both in terms of the degree of contamination and the limits of the contaminated zone.
APTIC-23576

### THE INFLUENCE OF ALUMINUM-WORKS EXHALATIONS ON THE CONTENT OF FLUORIDES IN SOIL AND GRASS.

Pol'nohospodarstvo, 10 (4):257-262, 1964.
Translated from Slovak. Belov and Associates, Denver, Colo., 7p. June 26, 1970.
Eugen Hluchan, Jan Mayer, and Emil Abel.
Identifiers: *Fluorides, *Grass, *Soils, Plants (botany), Aluminum, Czechoslovakia, Primary metallurgical processing.

Between 1958 and 1962, fluoride analyses were carried out on 338 soil samples and 72 grass samples from the vicinity of an aluminum plant. Soil from the south side of the plant showed fluoride values as high as 91.0 mg. Values for the remaining area ranged from 4.8 to 53.1 mg, averaging 20 to 29 mg. In contrast, the average fluoride value for soil from an uncontaminated area was 13.6 mg. Grass samples showed fluorides to a value of 118.7 mg in 100 g of dry substance, while the fluorine content of light dust reached a value of 5.0 mg/100 g of fresh grass. The content of fluorine compounds in soil and grass decreased with increasing distance from the plant. The determined values in the proximity of the plant represent a multiple transgression of the natural content of fluoride in soil and grass.
APTIC-23579

### FLUORINE DAMAGE IN THE LOWER FRICK VALLEY.

(Die Fluorschaden im unteren Frichtal). Schweiz. Arch. Tierheilk., 101 (1):1-4, 1959. (Presented at the Swiss Veterinary Society, General Convention, Brunnen, 1959.) Translated from German. Belov and Associates, Denver, Colo., 5p., July 10, 1970.
H. Reinhard.
Identifiers: *Fluorine compounds, *Plant damage, Crops, Aluminum, Europe, Primary metallurgical processing.

Even though the only aluminum produced in Germany today is manufactured by an electrolytic method, fluorine emissions are still 500 kg per day. In the area of one plant, the quantity of fluorine sedimented per acre in 1956 amounted to approximately 7 kg at 300 m from the plant, decreased rapidly to 0.9 kg at 700 m, and then decreased slowly with increasing distance. Severe clinical phenomena have been observed on vegetation at quite distant locations and can be attributed only to airborne fluorine. Moreover, feed plants (hay and grass) have been damaged, even when their fluorine levels were below those considered toxic by most authors.
APTIC-23580

### THE INFLUENCE OF COAL GAS ON TREES ON PARKWAYS AND STREETS.

(Einfluss des Leuchtgases auf die Promenadenund Strassenbaume). Z. Deut. Landwirthe, 1855: 151; Ibid., 1859: 360. 6 refs.
Translated from German. Belov and Associates, Denver, Colo., 2p., July 10, 1970.
H. Grouven.
Identifiers: *Trees, *Plant damage, *Streets, Germany, Soils, Coal, Metal fabricating and finishing, Ammonium compounds, Arsenic compounds, Lead compounds, Sulfur compounds.

Attention is called to the fact that trees on a number of European streets and boulevards have died when grown in soil contaminated by burned oily substances and sulfur and ammonia compounds from adjacent coal gas conduits. This has occurred even where cast iron pipes are used. Another source of vegetation damage is the arsenic and lead contained in dust emissions from foundries.
APTIC-23581

### A CONTRIBUTION TO THE RECOGNITION PROBLEM OF PLANT DAMAGE INDUCED BY IMMISSIONS.

(Ein Beitrag zum Problem der Erkennung von immissionsbedingten Pfanzenschadigungen). Schriftenreihe Landesanstalt Immissions-und Bodennutzungsschutz Lands Nordrhein-Westfalen (Essen), 1969:73-79. Translated from German. Belov and Associates, Denver, Colo., 15p., July 1, 1970.
G. Scholl.
Identifiers: *Sulfur dioxide, *Plant damage, *Soils, Plant growth, Germany, Petroleum refining, Fertilizer manufacturing, Ph.

Turnips, barley, and trees growing on farms bordering a fertilizer manufacturing plant and a refinery exhibited disturbed growth, partial defoliation, and leaf discoloration. When sulfur dioxide emissions in the area were determined to be of a magnitude sufficient to cause plant damage, the question of emission effect on the fertility of soil was clarified in corresponding soil investigations. Soil analyses revealed a 30-50% decrease in 'root soluble' nutrients, significantly lower pH values, and a decreased base activity that correlated with an abnormally high sulfate content in the soil as well as in spring water and rivers. These results show that the acidifying action of sulfur dioxide can have an adverse influence on the alkaline balance of light soil.
APTIC-23583

### EFFECTS OF SOME EXHALATIONS ON AGRICULTURAL ANIMALS.

(Ucinky nekterych exhalaci na hospodarska zvirata). Ochrana ovzdusi, 1969:122-125, Aug. 1969. 15 refs. Translated from Czech. Belov and Associates, Denver, Colo., 14p., June 16, 1970.
K. Hais, and J. Masek.
Identifiers: *Cattle, *Health impairment, Economic losses, Legislation, Maximum allowable concentration, Acute, Chronic, Morbidity, Mortality, Digestive system, Membranes, Metabolism, Synergism, Toxicity, Fluorosis, Metal poisoning, Czechoslovakia, Fly ash, Chemical processing, Reactors (nuclear), Mineral processing, Primary metallurgical processing, Fertilizing, Arsenic compounds, Fluorine compounds, Sulfur dioxide.

The effects of various pollutants on farm animals are discussed. The emissions from such sources as power plants, metal processing, cement works, chemical industries, fertilizing, and nuclear installations are described. The effects of the various pollutants can vary, depending upon such factors as concentration, climate, age of animals, health of animals, and individual sensitivity. Inhalation of ashes, cinders, or other light particulates causes irritation and inhibits important digestive processes. Sulfur dioxide irritates mucous membranes and disrupts metabolic processes. The symptoms of acute and chronic arsenic poisoning are discussed. A considerable degree of toxicity for cattle is noticed from power plant ashes. Bees show a marked effect from exposure to arsenic compounds. Typical symptoms of fluorosis in cattle are dental changes. Synergistic effects of pollutants are mentioned. The general air quality of Czechoslovakia is discussed, and current legislation, including air quality standards, is described. An estimation of economic damages due to air pollution is given.
APTIC-23624

### ON THE DIFFERENT INFLUENCES OF SULFUR DIOXIDE ON THE NEEDLES OF VARIOUS TWO YEAR OLD LARCH HYBRIDS. 10. PUBLICATION OF THE STUDY COMMITTEE FOR FLUE GAS RESEARCH IN FORESTRY, THARANDT.

(Ueber den unterschiedlichen Einfluss von Schwefeldioxid auf die Nadeln verschiedener 2jahriger Larchenkreuzungen. 10. Veroffentlichung der Arbeitsgemeinschaft fuer forstliche Rauchschadenforschung Tharandt). Study Committee for Flue Gas Research in Forestry, Tharandt (West Germany), Pub. 10, p. 312-316, 1964 ( ). 12 refs. Translated from German. Belov and Associates, Denver, Colo., 10p., July 6, 1970.
H. Schonbach, H. G. Dassler, H. Enderlein, E. Bellmann, and W. Kastner.
Identifiers: *Sulfur dioxide, *Trees, *Toxic tolerances, Tip burn, Genetics, Germany, Stack gases.

Research involving the development of sulfur dioxide-resistant coniferous trees is described. The larch tree was selected for breeding, since it looses its needles in the winter, similar to decidu-

ous trees, which are more resistant to SO2. Two year old larches developed from directed cross-pollination, partly from European larches and partly from the Japanese larch, were exposed in a controlled atmosphere greenhouse for periods of 10 to 50 hours to SO2 concentrations of 0.34 to 0.73 ppm. Damage evaluation was standardized by a needle-damage scale of 1-10. On the average, all hybrid trees exhibited a greater resistance to SO2 than the pure trees. Hybrids from two different strains of Japanese larch had significantly different responses. The degree of resistance of the various breeds is based mostly on genetics. This indicates that the development of a resistant strain from direct cross-pollination is a promising possibility.
APTIC-23625

### FLUORINE ABSORPTION THROUGH THE BARK OF SHOOTS AND ITS EFFECTS.

Angew. Botan., vol. 19:172-181, 1937. Translated from German. 10p.
G. Bredemann, and H. Radeloff.
Identifiers: *Trees, *Plant growth, *Fluorine compounds, Seasonal, Plant damage, Germany.

The effects of fluorine absorption on the shoots of plants and trees are investigated. The primary goal of the research is to determine whether the fluorine compounds which penetrate the bark of the shoots in an earlier season can affect the spring growth of the plant and/or effectively disturb the identification of fluorine fume damage on spring growth. Shoots accumulate fluorine-containing waste gases more or less in their barks, as much a result of exposure in winter as in summer. They are also capable of, but seldom do, store up accumulations in the xylum in water soluble and insoluble forms. The blossoming of branches and the further development of new growth are not noticeably injured by the fluorine compounds which are stored in the bark. All new outgrowths of fluorine-containing branches remain free of fluorine in a fume-free atmosphere. Proven fluorine content in spring growth is regularly a proof of a new fluorine fume effect during or after the blossoming.
APTIC-23639

### ON THE HORIZONTAL NUTATION OF THE STEMS OF PISUM SATIVUM AND SOME OTHER PLANTS.

(Ueber die horizontale Nutation der stengel von Pisum sativum und ieniger anderen Pflanzen). Bot. Centralbeich. Bech., vol. 19:129-138, 1901. 2 refs. Translated from German. Belov and Associates, Denver, Colo., 15p., July 1, 1970.
D. Neljubow.
Identifiers: *Nutation, *Peas, *Fuel gases, Vegetables, Plant growth, Ussr, Coal, Humidity, Light radiation, Temperature.

Many workers who observed the growth (in darkness) of seedlings of Pisum sativum, Vicia sativa, and Ervum Lens have noticed that their shoots are sometimes in a horizontal position and then twist and grow in different directions, but usually not deviating too much from the horizontal plane. Pea seedlings were germinated in sawdust at 25 C and 21-22 C, in both cases in a dark room saturated with water vapor. The seedlings, which nutated predominantly in the horizontal plane, served for the following experiments: one part was placed in a cold orange grove, partially in darkness and partially under light, while the remainder were exposed to light in the same room where they had been earlier. After two days the stems of seedlings in both groups twisted at a nearly right angle so that the younger part of the plant was directed vertically upwards. When other experiments were conducted in order to clarify the effect of various exterior influences, the normal vertical growth was only observed at lower temperatures or under the influence of light, and the shoots always grew horizontally in darkness at an elevated temperature. However, when the experiment was repeated several months later, the shoots nutated horizontally under the influence of low temperatures and light. A further series of experiments indicated that the horizontal position of the stem of the pea in the laboratory atmosphere was caused by coal gas and its investigated components which had contaminated the laboratory environment and were even in very small quantities damaging to seedling plants.
APTIC-23660

### ON THE ABSORPTION OF HARMFUL SUBSTANCES THROUGH TREE BARK.

Wiss. Z. Tech. Univ. Dresden, vol. 3, Nov. 14, 1961. 12 refs. Translated from German. 10p.
Kurt Garber.
Identifiers: *Trees, *Retention, *Absorption, *Vapors, Asphalt, Tar, Germany, Chemical processing, Fertilizer manufacturing, Fertilizing, Transport, Hydrofluoric acid, Ammonia, Fluorine.

The absorption of fluorine, fluoride compounds, tar, asphalt vapors, and ammonia through the bark of trees and bushes is reported. Absorption of these substances through bark during the dormant winter season was demonstrated in simulated laboratory experiments. Examination of field specimens obtained in the vicinity of a superphosphate plant indicated that the fluoride content of the bark was inversely in agreement with the distance from the source. A similar observation was made of the woody material but to a considerably lesser degree. Exposure of trees and pruned branches to HF vapor resulted in a bark concentration dependent on the exposure time and a wood concentration reflecting the exposure intensity. Applying a 2% solution of sodium fluoride to the branches caused a 50 % increase in the observed fluoride content of the wood portion. Almost all the fluoride vapor exposed trees were damaged as exhibited by delayed spring growth. The leaves of exposed trees contained 2-3 times the fluoride as the control specimens. Examination of dormant branches from the vicinity of tar and asphalt processing facilities clearly indicated the presence of these substances stored in the bark, and, depending on the kind of plant, that more or less of these substances were transferred to the wood. Rough bark appeared to enhance the pick-up of the substances. The transfer of these materials to spring growth was in most cases very slight. Similarly, dormant branches were exposed to ammonia and, while NH3 could be detected in the bark in all cases, it could not be detected in the wood in all cases. The effect of low concentrations for long periods of time was greater than that of high concentrations for short periods of time. High-concentration, short-term exposure of NH3 acted as a fertilizer, causing earlier sprouting and better leaf color. Low-concentration, long-term exposures had a detrimental effect. By late May, the ammonia content of the test specimens was the same as that of the control specimens.
APTIC-23661

### STUDIES OF THE PROBLEM OF INDIVIDUAL SMOKE RESISTANCE OF SPRUCES.

(Beitraege zum Problem der individuellen Rauchhaerte von Fichte). Arch. Forstw., 13 (2):177-210, 1964. 17 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 51p., Oct. 16, 1969.
Eberhart Pelz, and Jan Materna.
Identifiers: *Trees, *Toxic tolerances, *Smokes, Leaves, Plant damage, Plant growth, Czechoslovakia, Germany, Sulfur dioxide.

A study of damage to spruce trees due to air pollution is presented. About 900 trees were studied and grouped into resistance classes according to their phenotypical smoke resistance. Relationships between age, quality of growth site, degree of needle coverage, and weather conditions were determined. Trees in different classes exhibited different growth patterns, due to different physiological activities of the trees. Trees sensitive to damage had higher concentrations of sulfur in their needles, due to a higher degree of sulfur dioxide intake. Intensive studies of the needles indicate differences between sensitive and non-sensitive spruces in terms of water circulation, glycides, amino acids, and potassium levels. These results can be practically utilized in forestry by providing valuable help in cultivating forest trees which are smoke resistant.
APTIC-23678

### PARTIAL RESULTS OF RESEARCH IN THE SMOKE REGION OF THE KRUSNE HORY MOUNTAIN RANGE.

(Nektere vysledky vyzkuma v krusnohorske kourove oblasti). Translated from Czech. Belov and Associates, Denver, Colo., 19p., Jan. 20, 1970.
Jan Materna.
Identifiers: *Plant damage, *Plant indicators, *Smokes, *Sulfur dioxide, Czechoslovakia, Forests, Mountains, Trees.

Following the rapid advance of damage by smoke emissions to forest flora in the eastern section of the Krusne Hory mountain range, sulfur dioxide measurements were taken in the most affected areas. Where sulfur dioxide was present, the average concentration was one mg per cu m of air. The influence of precipitation on this concentration is considerable, as is that of fog and, to a lesser extent, wind direction. The measured concentrations are high enough to cause a decrease in production and damage to plant life. They correspond to calculated and measured values of the sulfur content in the assimilative organs of injured plants. Further research indicated that fertilizers will increase the resistance of assimilative organs of the plants and promote new growth, even in trees highly sensitive to SO2. Related investigations pertained to the possibility of using forest flora, especially spruce, to indicate the action of smoke gases and their presence in the atmosphere and to the significance of forest flora for cleaning air in industrial regions. Based on measurements of sulfur in needles and the turbidity of water extracts of needles, it is concluded that spruce trees are suitable for proving the influence, and its extent, of smoke emissions. Forest flora are shown to have only a negligible role in air purification near large enterprises. On the other hand, their ability to absorb sulfur dioxide is great enough for them to have a prominent role in purification where sulfur dioxide levels do not exceed 0.2 mg per cu m of air.
APTIC-23689

### EFFECT OF CERTAIN LETHAL GASES UPON PLANTS AND ANIMALS.

In: Growth of Plants, New York, Reinhold Publishing Corp., 1948, Chapt. 5, p. 172-203. 43 refs.
William Crocker.
Identifiers: *Plant damage, *Phytotoxicants, *Gases, Laboratory animals, Leaves, Respiration, Toxicity, Mercury, Hydrocyanic acid, Ammonia, Chlorides, Chlorine, Ethylene, Sulfur dioxide, Hydrogen sulfide, Vapor pressure.

The effects of various toxic gases on plants and animals are discussed. Ethylene is the constituent of artificial illuminating gas that injures plants in greenhouses when this gas seeps through the soil and into the houses. Hydrocyanic acid is the most deadly constitutent of artificial illuminating gas to plants growing outdoors near leaking gas pipes. Most natural gases have very low toxicity to plants because they contain no ethylene or other unsaturated hydrocarbons, and no HCN or other highly toxic gases. Some natural gases contain H2S which might injure plants if the gas were not thoroughly scrubbed. Mercuric chloride, calomel, or organic mercury fungicides must be used with caution on soils in greenhouses or other enclosed spaces because the soils reduce these compounds to metallic mercury which has sufficient vapor pressure, especially at higher growing temperatures, to injure plants throughout the enclosed

space. The most delicate plants are injured by 0.46 ppm of sulfur dioxide with seven hours' exposure. Animals endure 33 ppm for 500 hours without injury. Sulfur dioxide kills the leaf parenchyma of the medium-aged leaves, thus cutting down assimilation, but there is no reduction of assimilation or growth if no tissue is killed, that is, there is no 'invisible injury.' Darkness and partial wilting increase the resistance of plants to SO2, partly at least by closing the stomates. Hydrogen sulfide differs from SO2 in several ways as to its effect upon plants; it requires a much higher concentration to injure plants, 40 to 400 ppm; it kills the young leaves and stems rather than spotting middle-aged leaves, and its toxicity is not so greatly reduced by darkening and by wilting the plants. Chlorine acts much like SO2 on plants and spots them in even lower concentrations. Chlorinated water has relatively low toxicity for land plants when used either for syringing or watering them. By use of the continuous air-flow method, a study was made of a relative sensitiveness of plant and animal pathogens, sclerotia, seeds, green plants, and houseflies, rats and mice to the five gases, Cl2, HCN, H2S, NH3, and SO2. Chlorine and SO2 showed high toxicity to pathogens and other gases low toxicity. Sclerotia and seeds were little injured by any of the gases. Green leaves were very sensitive to these gases, and the gases showed the following descending order of toxicity: Cl2, SO2, NH3, HCN, and H2S. Green stems were more resistant than leaves, with no significant difference in the degree of toxicity of the five gases. Animals were readily killed by HCN and H2S and the descending order of toxicity for animals was HCN, H2S, Cl2, SO2, and NH3.
APTIC-23696

### EFFECTS OF CONTINUOUS EXPOSURE OF NAVAL ORANGES TO NITROGEN DIOXIDE.

Preprint, California Univ., Riverside, Statewide
Air Pollution Research Center, 16p., 1970 (*). 12
refs.
C. R. Thompson, E. G. Hensel, G. Kats, and O. C.
Taylor.
Identifiers: *Citrus, *Plant damage, *Nitrogen dioxide (no2), Continuous, Leaves, Greenhouses, Statistical analyses.

Navel orange trees in greenhouses were continuously exposed to 1.0, 0.5, 0.25, 0.125, and 0.0625 ppm of nitrogen dioxide beginning on April 15, 1968. Fumigation at the two highest levels was discontinued after 35 days when the trees showed severe defoliation and leaf chlorosis, and high nitrogen accumulation in the leaves was found. Treatments at the three lower levels continued until the fruit was picked on Jan. 30, 1969; these longer-term, lower-term, lower-level exposures more nearly compare with actual field conditions. The trend toward an increased leaf drop, fruit drop, and yield when the data are considered separately, and the statistical validity of these three levels when considered together and compared to filtered air, suggest that at some level below 0.25 ppm, NO2 becomes toxic to these trees and causes the deleterious effects observed. At present, it seems that none or minimal economic damage is being caused by NO2; however, if atmospheric levels increase by a factor of two, some damage can be expected. (Author conclusions modified)
APTIC-23758

### THE EFFECTS OF AIR POLLUTION ON PLANT GROWTH.

In: The Effects of Pollution on Living Material.
Symp. Inst. Biol., no. 8:81-87, 1959. 14 refs.
J. K. A. Bleasdale.
Identifiers: *Plant growth, *Smokes, *Sulfur dioxide, Plant damage, Photosynthesis, Great britain, Soils, Coal.

In the United Kingdom, the most widespread and economically important air pollutant is sulfur dioxide-containing coal smoke. The smoke affects the environment for plant growth by reducing the amount of light available to the plants, by altering soil conditions, and by contaminating the air with foreign gases. In reducing the light available to plants for photosynthesis, smoke haze reduces their growth. The tarry deposit on leaves further reduces light and lowers the assimilation rate. Rain falling in or near an industrial area dissolves the predominantly acid polluting gases from the air and leaches bases from the soil. In increasing soil acidity, the rain reduces the number of soil bacteria and sometimes the availability of plant nutrients. There is evidence that gaseous pollutants affect processes involving cell division, namely the rates of tiller production and leaf formation. In addition, coal smoke and sulfur dioxide increase the rate of leaf senescence. The most serious effect of pollution is seen in farming, where pollutants make re-seeding of grassland impractical.
APTIC-23766

### DETERMINATION OF THE EFFECT OF SULFUR DIOXIDE ON PLANT LIFE BY FIELD EXPERIMENTS. PART I. METHODOLOGY AND EVALUATION OF RESULTS.

(Freilandversuche zur Ermittlung von
Schwefeldioxydwirkungen auf die Vegetation. I.
Teil: Uebersicht zur Versuchsmethodik und
Versuchsauswertung). Text in German.
Forschungsber. Landes Nordrhein-Westfalen, no.
1118, 102p., 1962.
Robert Guderian, and Heinrich Stratmann.
Identifiers: *Plant damage, *Toxicity, *Sulfur dioxide, Acute, Chronic, Crops, Fruits, Trees, Potatoes, Plant growth, Toxic tolerances, Germany, Air quality measurements, Continuous monitoring, Phytotoxicants.

The relationship between atmospheric sulfur dioxide levels and their phytotoxic effects was studied in five experimental stations and one control station which differed only by their atmospheric SO2 content on 15 agricultural and horticultural plants, on 4 fruit cultures, 2 fruit-bearing shrubs and 5 silvicultural plants. Sulfur dioxide concentrations were registered continuously by Woesthoff instruments, and their median levels for certain time periods were determined as were the plant reactions at various stages of their development. Acute and chronic damage caused by the various emission levels was demonstrated on the potato plant, the gooseberry shrub, and the larch tree. Young and old leaves of potato plants were much more susceptible to SO2 damage than leaves of median age. The SO2 effect on potatoes was manifested both by a decrease in size as well as in the number of tubers. Leaves of gooseberries manifested intercostal necroses, then fell off; the berry yield was almost nil. Generally the resistance of plants and cultures to SO2 varied widely not only between species but also between developmental stages and emission levels. The fungicidal effect of SO2 on plant pests Microsphaera quercins, Taphrina deformans, and Rhizoctonia solani was confirmed. The phytotoxic effects of the inorganic fungicide Cupravit Ob 21 depended on SO2 emission levels.
APTIC-23772

### THE EFFECTS OF AIR POLLUTION ON PLANT LIFE.

A.M.A. Arch. Ind. Health, vol. 14:229-245, July-
Dec. 1956. 86 refs. (Presented at the American
Industrial Hygiene Association, Annual Meeting,
17th, Philadelphia, Pa., April 23-27, 1956.)
Donald F. Adams.
Identifiers: *Plant damage, Leaves, Necrosis, Tip burn, Plant growth, Plant indicators, Enzymes, Inhibition, Thresholds, Toxicity, Toxic tolerances, Smog, Hydrofluoric acid, Fluorides, Sulfur dioxide.

Knowledge of the range of foliar expressions of plants exposed to atmospheric pollutants is extremely useful to those engaged in the study of the scope and severity of an air-pollution problem. The wide variations in susceptibility and characteristic response of common species to typical contaminants provide a convenient method for identifying, determining the distribution of, estimating the level of, and providing a collection medium for subsequent chemical analysis for a pollutant. A detailed review of the progress of research on the effects of sulfur dioxide, hydrogen fluoride, and 'Los Angeles-type' smog since 1950 is presented (with work published prior to 1950 cited to provide continuity whenever necessary). Fluoride appears to be a cumulative phytotoxicant which may move through the plant vascular system to the leaf tip or margin and produce foliar necrosis upon accumulation of a 'threshold concentration.' Evidence also points toward possible enzymatic inhibition. Sulfur dioxide and smog exposures result in foliar injury only if the rate of tissue absorption exceeds the rate at which the plant can effectively neutralize the toxic agent. Smog, however, can produce growth inhibition without producing visible injury, whereas sulfur dioxide does not produce this so-called invisible injury. Reference is made to a catalogue of common weeds according to their characteristic foliar response and susceptibility to a number of pollutants. (Author summary)
APTIC-23794

### AIR POLLUTION INJURY TO VEGETATION.

Public Health Service, Raleigh, N. C., National
Air Pollution Control Administration, 44p., 1970.
43 refs. CFSTI: PB 193480
Ibrahim Joseph Hindawi.
Identifiers: *Plant damage, Economic losses, Acute, Chronic, Plants (botany), Leaves, Necrosis, Stippling, Tip burn, Plant growth, Plant indicators, Synergism, Thresholds, Toxicity, Toxic tolerances, Hydrochloric acid, Chlorine compounds, Ethylene, Peroxyacetyl nitrate, Nitrogen dioxide (no2), Sulfur dioxide, Ozone, Gases.

Pollutant gases causing damage to vegetation, their sources, the principal plants each affects, and the symptoms of damage are reviewed and illustrated with full-color photographs. Gases considered include ozone, peroxyacetyl nitrate, nitrogen dioxide, sulfur dioxide, hydrogen fluoride, chlorine, and ethylene. Both the acute and chronic damage caused by SO2 are described as in the synergistic effect of ozone and SO2 working in combination. Types of damage described and illustrated include necrosis, fleck, stipple, lesions, bleaching, bleached spotting, glazing, silvering, bronzing, tip and margin burn, withering, leaf abnormalities, early abscission, dwarfing, and growth suppression. The structure and function of leaves and the mechanisms of damage are described. Damage thresholds are listed in terms of concentration and term of exposure. Plants as indicators of pollution are discussed, and representative samples are named. Agents other than air pollutants causing plant damage are identified and the similarity of symptoms among these agents and toxic gases is discussed. Twenty-seven varieties of vegetation damaged by air pollution are pictured. Comment is made on the geographic extent of air pollution plant damage. The cost of pollutant damage to vegetation is estimated nationally to be 500 million dollars annually; California alone suffers an estimated 132 million dollars damage annually and a 50% loss of the citrus fruit crop.
APTIC-23851

### NECROSIS CAUSED BY FLUORINE.

(Les necroses due au fluor). Pollut. Atmos.
(Paris), 8 (30):176-184, June 1966. Translated from
French. Belov and Associates, Denver, Colo., 9p.,
Sept. 4, 1970. (Also: Revue Forestiere, no. 12,
Dec. 1965.)
M. J. Bossavy.
Identifiers: *Necrosis, *Fluorine compounds, Leaves, France, Meteorology.

The shape, color and evolution of necrosis due to fluorine are described for a certain number of leaf-bearing coniferous vegetation according to the

stage of development of the leaf. The experiments of Professor Holland, 1908-1909, and his album containing pen sketches and a collection of samples are presented. The only common characteristic to note is that such flaws begin to be seen at the tips of the needles; in the leaves, they will be noticed either at the very tip of the leaves, in long narrow leaves, or else almost simultaneously at the tip and on the edge of the leaf if such is a wide and whole leaf. If the leaf has serrated edges, the necrosis is evident at the points of tips of the lobes. Often the tainted parts assume a 'V' shape, the point directed towards the leaf stalk, but it quickly moves along the leaf blade and assumes a very different shape. In the cherry and other plants, the tainted parts will be easily detachable, leaving an undulating line where they have been severed. Little patches of yellowish color will often be dispersed along the blade and inside the leaf itself. The color of the damaged parts varies from black to a brown or ruse color. Sometimes all needles of the same age on a given branch will show necrosis of the same color obviously in the same stage of development. Characteristics are cited for the cherry tree, chestnut, alfalfa, walnut, peach, pear, sainfoin, vine, lime tree, larch, hawthorn, saffron, barberry, gentian, millepertuis, myrtle, lily of the valley, solomon's seal, silene, the common pine, pectin fir, and spruce. Meteorological factors are also mentioned.
APTIC-23852

### OZONE TOLERANCE OF PETUNIA LEAVES AS RELATED TO THEIR ASCORBIC ACID CONCENTRATION.

Preprint, Los Angeles State and County
Arboretum, Arcadia, Calif., 28p., 1970. 29 refs.
George P. Hanson, Linda Thorne, and Carlos D.
Jativa.
Identifiers: *Ozone, *Petunias, *Toxic tolerances, *Ascorbic acid, Tobacco, Leaves, Trees, Genetics.

The relationship of ozone tolerance to ascorbic acid content in the leaves of petunias was investigated. The leaves of two tolerant and two sensitive varieties petunias were grouped according to size, age, and position. Within all varieties, the higher the ascorbic acid content, the higher the ozone tolerance. Correlations between ascorbic acid concentration and surface area and leaf thickness were made. Genetic studies indicated that leaf thickness may be unrelated to ozone tolerance. Cross-breeds of the sensitive and insensitive plants were examined. Comparisons of petunia plants at different physiological ages suggest that leaves of a given size increase in ascorbic acid content as the plant becomes more mature and begins to flower. The possibility that ascorbic acid may be involved in ozone tolerance in other species, namely tobacco and pine, is discussed. (Author abstract modified)
APTIC-23870

### SMOKE DAMAGE TO STONE FRUIT.

(Rauchschaden an Steinobst-Fruchten). Nachrbl.
Deut. Pflanzenschutzdienst (Berlin), no. 9:91-92,
1929. Translated from German. Belov and
Associates, Denver, Colo., 4p., Sept. 8, 1970.
W. Kotte.
Identifiers: *Fruits, *Plant damage, *Smokes, Necrosis, Bricks, Germany, Mineral processing, Hydrofluoric acid.

Of the fruit trees in the neighborhood of a brickyard, the apples and cherries were undamaged, while in contrast the damson plums, yellow plums, and yellow Victoria plums showed damage on foliage and fruit. Damage symptoms of the damsom plums were necrotic spots of tissue that appeared either as sunken patches about fingernail size or, in cases of greater extend, as an apical zone of retarded growth. The diseased tissue was coffee brown in color, and beads of sap frequently could be found around the border of the necrotic zone. Microscopic examinations revealed that the epidermal cells were filled with brown granular masses instead of dark blue anthozyan. The pericarpal tissue, which in a healthy condition exhibits vesicular, almost empty appearing cells with transparent walls, was small-celled, with brown colored cell walls covered with brown granular concretions. Limitation of the damage to the end of the fruit is explained by the fact that here the rain drops hold on longest and the gases dissolved in the water have their strongest influence. The cause of the smoke damage is attributed to hydrofluoric acid.
APTIC-23874

### SOME EFFECTS OF A SOLUBLE NPK FERTILIZER ON SENSITIVITY OF EASTERN WHITE PINE TO INJURY FROM SO2 AIR POLLUTION.

Forest Sci., 16 (1): 72-73, March 1970. 1 ref.
Cosimo Cotrufo, and Charles R. Berry.
Identifiers: *Eastern white pine, *Toxic tolerances, *Fertilizing, *Sulfur dioxide, Trees, Banding, Chlorosis, Mottling, Necrosis, Potassium compounds, Nitrogen, Phosphorus compounds.

Sulfur dioxide-sensitive and -tolerant clones of eastern white pine (Pinus strobus L.) were fertilized with a soluble NPK formulation (23:19:17) and artificially exposed to SO2 when the needles were 25-50 mm long. Similarly fertilized potted clones were exposed to ambient air in a field where SO2 was believed to be a major pollutant. The fertilizer application reduced the extent of necrosis of needle tips, a symptom of air pollution injury, in several sensitive clones. In the field experiment, other symptoms such as chlorotic banding and mottling, did not appear to be alleviated by fertilizer application. (Author abstract)
APTIC-23902

### RESULTS OF AN AIR POLLUTION DIAGNOSIS IN THE 'KLOSTERFORST MARIENTHAL' NEAR OSTRITZ (NEISSE).

(Ergebnisse einer Rauchschadendiagnose im
'Klosterborst Marienthal' bei Ostritz (Neisse).
Text in German. Arch. Forstw., 19 (2):99-106,
1970. 9 refs.
Herbert Lux.
Identifiers: *Plant growth, *Forests, *Sulfur dioxide, Plant damage, Diagnosis, Germany, Electric power production.

A forest district with moderate sulfur dioxide concentrations is used to demonstrate the fact that a sufficiently exact inventory of visually recognizable air pollution can be obtained both by exact enumeration of sample plots and by visual estimation for whole stands. However, the results of both methods are not comparable in every case. Growth decrease calculated for sample plots cannot be applied to visually-estimated damage classes. The number of fatally injured trees has increased since 1964 and correlates with the damage classes used. Thus the method of using damage classes is adequate. Local distribution and temporal progress of the damage clearly points to power plants in the area. The annual loss of growth per hectare is calculated as a percentage of the yield table growth on local plots. Thus the loss of growth (cu m/hectare) can be ascertained by means of yield tables for every stand according to damage class, age class, and site class. A growth inventory for the entire district is no longer needed.
APTIC-23942

### EFFECTS OF SULFUR DIOXIDE AND FLUORINE COMPOUNDS ON VEGETATION.

(Effets de l'anhydride sulfureux et des composes
fluores sur la vegetation). Station Federale de
Recherches de Chimie Agricole, Liebefeld-Bern,
Switzerland, Air Pollution Proceedings of the First
European Congress, on the Influence of Air
Pollution on Plants and Animals, Wageningen,
Netherlands, 1968, p. 111-135. 81 refs. Translated
from French. Belov and Associates, Denver,
Colo., 34p., Aug. 28, 1970.
E. Bovay.
Identifiers: *Plant damage, *Fluorides, *Sulfur dioxide, Fruits, Leaves, Trees, Photosynthesis, Plant indicators, Metabolism, Synergism, Thresholds, Toxicity, Europe, Soils, Stack gases, Industrial emission sources, Reduction.

The sources of sulfur dioxide and fluorine pollutants are described, and the damage caused to plants by these compounds are related. Sulfur dioxide penetrates to the interior of plants through the stoma; therefor every condition favoring the opening of the stoma also increases the assimilation of SO2. The caustic action of SO2 is due to its reducing action, which can affect plant metabolism. Sensitivity to SO2 depends on such factors as age, nutritive state, and individual tolerances. Relationships between pollutant concentration and time of exposure are a determining factor in threshold limitations. A distinction between plant injury and damage is made. Various attempts to observe and control atmospheric pollution are described. Fluorine compounds are among the most toxic of pollutants. Fluorine accumulation in soils and plants is discussed. The effects of fluorine on various types of plants are noted. Synergistic action can occur when certain elements introduced by fertilizers react with fluorine compounds found in the atmosphere. Most plants seem to have a fluorine threshold beyond which photosynthetic processes can be invisibly damaged. Certain plants, due to their highly sensitive nature, can act as indicators of atmospheric pollution. Recent experiments involving the effects of fluorine on fruit trees are described.
APTIC-23950

### SEASONAL CHANGES IN CARBOHYDRATES AND ASCORBIC ACID OF WHITE PINE AND POSSIBLE RELATION TO TIP BURN SENSITIVITY.

Forest Service, Asheville, N. C., Southeastern
Forest Experiment Station, USDA Forest Service,
RN-SE-124, 4p., Dec. 1969. 8 refs.
Robert L. Barnes, and Charles R. Berry.
Identifiers: *Carbohydrates, *Ascorbic acid, *Tip burn, *Metabolism, Seasonal, Trees, Plant growth, Meteorology.

Changes in amounts of total soluble carbohydrates and ascorbic acid were determined and related to needle length of eastern white pine during June-July 1967 at a site where emergence tipburn occurs rather frequently. Results were compared to similar studies made during the previous year at a location where very little air pollution injury occurs. At the 1967 site, sugar values remained low through the early growing season, and several instances of injury to clones sensitive to tipburn occurred as late as mid-July. Sugar levels fluctuated somewhat, increasing during fair weather and decreasing during cloudy weather. Ascorbic acid levels increased more regularly as the needles matured and with less short-term fluctuation than did soluble carbohydrates. It is suggested that the relatively low carbohydrate content is indicative of a slow maturation of needle tissues, which may be related to a prolonged sensitivity to air pollutants. If so, the amount of soluble carbohydrates or ascorbic acid may be more meaningful than needle length as an indication of needle maturity. (Author abstract modified)
APTIC-23998

### INVESTIGATION AND APPRAISAL OF FLU-GAS DAMAGE.

(Untersuchung und Begutachtung von
Rauchschaden). Hamburg Staatsinst. Angew.
Botanik Jahresber., vol. 6:126-127, 1939. 1 ref.
Translated from German. Belov and Associates,
Denver, Colo., 4p., June 12, 1970.
H. Radeloff.
Identifiers: *Fluorine compounds, *Plant damage, *Bees, *Sulfurous acid, Animals, Orchards, Trees, Germany, Stack gases, Inorganic acids.

Waste gases containing fluorine and sulfurous acid are reported to damage plants and bees. Branches of fruit trees afflicted by fluorine had leaves which

showed numerous spots, intercostal discolored stripes, or also withered tips and periphrasis. All which remained, in some cases, were the blackish brown withered remains of the leaves. At a location in central Germany, the bees of a migrating stand died without any immediately apparent reason. However, they had their hives in the vicinity of a plant working with fluorine, and the mass dying started quite suddenly with the same day on which the wind had changed in their direction. An investigation for sulfurous acid in 36 plant samples resulted in various causes, from manufacturing plant flue gases to gas remnants coming from a habitation treated with sulfur.
APTIC-24024

### MILDEW ON OAK TREES AND FLUE-GAS DAMAGE.

(Eichenmehlau und Rauchgasschaden). Z.
Pflanzenkrankh Pflanzenschultz, vol. 45:1-2, 1935.
Translated from German. Belov and Associates,
Denver, Colo., 1p., June 18, 1970.
G. Koeck.
Identifiers: *Oak, *Sulfurous acid, *Plant indicators, *Fungi, Trees, Europe, Stack gases, Paper manufacturing, Inorganic acids.

The Oak mildew (Microsphaera alni var. quercina) could not be observed at any location which had been exposed to a considerable amount of flue gases containing sulfurous acid. This was especially evident along the southwest slopes of the Haeusel Mountains which are relatively heavily exposed to the flue gases coming from a paper mill in Hinterburg. Absence of oak mildew and similarly the absence of lichen in forests which also contain oaks can be taken as an indicator for the assumption that the region concerned is strongly exposed to flue gases. If one considers the usual control of the genuine mildew fungus by means of pulverized sulfa, which tranforms under the influence of the atmosphere into sulfurous acid and thus becomes fungicidal, the above observed phenomenon becomes quite understandable.
APTIC-24025

### LICHEN GROWTH AND AIR POLLUTION.

World Health Organization, Copenhagen
(Denmark), Regional Office for Europe, Proc.
Conf. Public Health Aspects Air Pollution Europe,
Milan, Italy, 1957, p. 96-102. 6 refs. (Nov. 6-14.)
A. Schinzel.
Identifiers: *Lichens, *Plant indicators, Plants (botany), Plant damage, Europe, Urban areas.

Lichens growing on trees, wood, concrete, and stone are sensitive indicators of the presence and degree of air pollution, as revealed by change and damage in the lichens and/or decrease of the number of species and forms. Results are independent of 'accidental' pollution that might occur at the time of sampling. Areas of differing degrees of pollution can be delimited and the direction and extent of polluted air streams can be determined. In general, specific pollutants cannot be detected. Examples are given by illustration of five cities, with specific zones delineated representing defined changes in the lichen growth of each zone. Innsbruck, for example, belongs to Zone IV (decrease in number of species and covering effect of deciduous bark, conifers and stones already free of lichens) with four large areas on zone V ('lichen desert' zone, showing only traces on deciduous trees) related to the location of industrial pollution sources.
APTIC-24034

### AIR POLLUTION AND ITS INFLUENCE ON VEGETATION.

World Health Organization, Copenhagen
(Denmark), Regional Office for Europe, Proc.
Conf. Public Health Aspects Air Pollution Europe,
Milan, Italy, 1957, p. 70-75. (Nov. 6-14.)
J. G. Ten Houten, and F. Spierings.
Identifiers: *Plant damage, *Hydrofluoric acid, *Sulfur dioxide, Alfalfa, Gladioli, Leaves, Plant indicators, Toxic tolerances, Europe, Industrial areas, Air quality measurements.

Investigations on the effects of hydrogen fluoride and sulfur dioxide on plants are reported. Fumigation chamber experiments established that the gladiolus variety 'Sneeuwprinses' is extremely susceptible to HF, whereas alfalfa appears to be a useful SO2 indicator. Gladiolus leaf analysis indicated a connection between the intensity of damage and fluorine content, and between these factors in relation to distance from the emitting source. Because of the high sulfur content of alfalfa leaves outside industrial areas, leaf analysis is a useful method for detecting SO2 damage primarily in cases of severe plant injury. Air quality measurements were made in different areas to establish any correlations with chemical leaf analysis. As a result of 110 measurements with SO meters in an area containing SO2 pollution, a daily average of 3-4 mg SO2 was calculated as about the danger limit for plant damage. A monthly total amount of 30-60 ppm fluorine taken up by lime soaked filter paper was the limit at which damage was found on the susceptible gladiolus variety planted next to the measuring point. At 60-120 ppm, slight damage was found on less susceptible crops. Severe smoke damage to fruit trees due to HF was established, the adjacent HF apparatus absorbing as much as a monthly total amount of 304 ppm.
APTIC-24036

### INHALATION TOXICITY OF HYDRAZINE VAPOR.

A.M.A. Arch. Ind. Hyg. Occupat. Med., 10 (6):476-490, Dec. 1954. 20 refs.
Charles C. Comstock, Lorraine H. Lawson, Earle
A. Greene, and Fred W. Oberst.
Identifiers: *Hydrazines, *Toxicity, Maximum allowable concentration, Acute, Chronic, Dogs, Liver, Lungs, Breathing, Toxic tolerances, Eye irritation, Azines, Vapors.

Hydrazine vapor is irritating to the eyes, nose, and throat. Studies on acute and chronic toxicities of the vapor have not developed a protection and therapeutic program. Research on laboratory animals may help in the development of such a program. Inhaled hydrazine vapor is toxic to laboratory animals. It causes lung damage, inflammation of the liver, focal interstitial nephritis, anorexia, loss in body weight, tremors, weakness, and, after prolonged exposures, convulsions followed by death. Daily exposure to concentrations of 6 (mg/cu m) over a six-month period produced very little pathology in dogs. Elevating the concentration to 18 (mg/cu m) produced marked effects and eventually some deaths. Anorexia and weight loss may be the earliest symptoms to occur in man and may constitute a warning sign of impending health hazard. On the basis of these experiments, it appears that the maximum allowable concentration for hydrazine is below 6 (mg/cu m) (5 ppm). (Author summary modified)
APTIC-24052

### ON THE EFFECTS OF INDUSTRIAL EMISSIONS ON THE POPULATION OF NEMATODA IN THE SOIL OF PINE FORESTS.

(Ueber Wirkungen von Industrieexhalaten auf
den Nematodenbesatz im Boden von
Kiefernwaldern). Pedobiol., vol. 8:289-295, 1968. 7
refs. Translated from German. Belov and
Associates, Denver, Colo., 11p., July 2, 1970.
Wilfried Bassus.
Identifiers: *Sulfur dioxide, *Soils, *Nematodes, Animals, Germany, Forests, Dusts, Ph.

In one of the largest pine regions in the German Democratic Republic damaged by industrial air pollution, the Duebemar Heide, changes in the soil nematode population were studied. By the action of sulfur dioxide, the density of the tree stands decreased considerably and a rich ground vegetation developed. Great amounts of dust containing high quantities of lime have changed the pH value of the humus cover from 3.7 up to 7. The total population density of the nematodes showed a significant reduction and an alteration of the species composition in the areas influenced by smoke. As a consequence of a more intensive microbial activity and a higher pH value, the percentage of semisaprophage, saprophage, and predatory nematodes increased considerably. In the undamaged areas, however, on the semiparasitic nematodes which feed on fungi and roots showed a high population density. The extreme raw humus conditions there seem to be very favorable for them. (Author summary)
APTIC-24063

### INVESTIGATION OF THE QUANTITATIVE RELATIONSHIP BETWEEN SULFUR IN PLANTS AND THE SULFUR DIOXIDE IN THE AIR. PART 2. DIURNAL VARIATION IN SULFUR NEAR UNAFFECTED AND GAS-ATTACKED PLANTS.

(Untersuchungen ueber quantitative Beziehungen
zwischen dem Schwefelgehalt von Pflanzen und
dem Schwefeldioxidgegalt der Luft. Teil 2.
Tagesgang im Schwefelgehalt bei unbeeinflussten
und begasten Pflanzen). Text in German. Z.
Pflanzenkrankh Pflanzenschultz, 77 (6):289-308,
June 1970. 61 refs. PART I. Ibid., 77 (4-5), April-
May 1970. PART III. Ibid., 77 (7), July 1970.
Robert Guderian.
Identifiers: *Leaves, *Plant damage, *Sulfur dioxide, Diurnal, Trees, Photosynthesis, Germany.

Fumigation of plants at different hours of the day reveals distinct diurnal changes in sulfur accumulation which exhibits a certain relation to intensity of photosynthesis, but does not coincide with the degree of leaf sensitivity. Apparent photosynthesis and sulfur accumulation reach their maxima in the late morning hours while leaf injury is most intense in the early morning hours. The decrease in leaf sensitivity during the light period seems to be associated with, among others, the formation of assimilates; further possible causes are discussed. Sulfur is also accumulated during the night hours, which may amount to about one-third of the highest daily values. Sulfur content of unfumigated plants also shows a distinct diurnal variation. These diurnal variations result from changes in dry substance. Level of sulfur accumulation varies considerably with the stage of plante growth. Degree of leaf injury on plants of different age does not show a distinct dependence upon the quantity of accumulated sulfur. Sulfur absorption by leaves of the same age decreased with increasing plant age. Fully developed leaves having the greatest photosynthetic gas exchange also had the greatest sulfur accumulation. The relationships in the degree of injury of different aged leaves change in respect to each other with level of concentration. Under exposure conditions of low concentration but of sufficient length to result in injury, older leaves are, in general, injured before younger ones. With increasing concentration, effects shift over to the younger leaves until finally, at high concentrations, the degree of injury on just fully developed leaves correlates with sulfur accumulation and apparent photosynthesis. Conifers also show distinct, age dependent differences in sulfur dioxide uptake and in the degree of injury. The youngest needles absorb the most sulfur dioxide. Sulfur dioxide absorption and also degree of injury increases with increasing growth of the new shoot, while the preceding year's needles show an inverse tendency. Dissimilar sulfur dioxide exposures may shift the natural relations in sulfur content. Long lived crops show an increase SO2 content with leaf age while older leaves on short lived plants often have a lower sulfur content than younger ones. Strictly comparable samples have to be taken when proving sulfur dioxide effects with the help of chemical leaf analysis. (Author summary modified)
APTIC-24084

### INVESTIGATION OF THE QUANTITATIVE RELATIONSHIP BETWEEN SULFUR IN

### PLANTS AND THE SULFUR DIOXIDE IN THE AIR. PART 3. SULFUR INJURED AND UNINJURED LEAVES.

(Untersuchungen ueber quantitative Beziehungen zwischen dem Schwefelgehalt von Pflanzen und dem Schwefeldioxidgehalt der Luft. Teil 3. Schwefelgehalt geschaedigter und ungeschaedigter Blatteile). Text in German. Z. Pflanzenkrankh Pflanzenschultz, 77 (7):387-399, July 1970. 50 refs. PART I. Ibid., 77 (4-5), April-May 1970. PART II. Ibid., 77 (6), June 1970.
Robert Guderian.
Identifiers: *Leaves, *Necrosis, *Sulfur dioxide, Acute, Plant indicators, Germany.

The sulfur content of necrotic portions of a leaf and those portions that are still green is determined by the past history of ambient sulfur dioxide concentrations. When an ambient level which causes acute injury is followed by a longer period of no sulfur dioxide or of only insignificant concentrations, then, the sulfur content of those parts still functioning may decrease below that of the necrotic portions. In practice, however, sulfur content of the green leaf portions is generally higher. Great differences in the sulfur content of injured and uninjured parts of the leaf probably result from sulfur dioxide effects and, therefore, are a reason why a separate chemical analysis for sulfur may be advantageous. If no separation is made, only leaves having a small proportion of necrosis should be sampled for (chemical) analysis because these reflect the level of sulfur dioxide pollution better than do severely injured leaves. In addition to the level of sulfur dioxide exposure, sulfur content of plants depends substantially on the duration of pollution-free periods. A single sample taken from vigorously growing, intermittently exposed plants is capable of reflecting only a casual situation. The danger of misinterpretations can be reduced by repeated sampling in the course of the vegetation period. The present results of investigations in both field and fumigation experiments concerning a quantitative relationship between sulfur content in plants and sulfur dioxide content of the air with attention to inner and exterior growth factors, make possible an evaluation of the chemical analysis of the leaf as proof of sulfur dioxide effects. The analysis, along with attention to precisely described presuppositions, is a valuable procedure for identifying sulfur dioxide pollution, also in areas with concentrations causing acute injury. The causes for opposing concepts about the diagnostic value of the analysis of plants could be clarified. (Author summary)
APTIC-24086

## 9. EFFECTS - MATERIALS

### STUDIES OF ATMOSPHERIC CORROSION OF STEEL.

(Studier i stals atmosfariska korrosion.) Text in Swedish. Jernkont. Ann., 152:477-484, 1968. 9 refs.
Ake Bresle, and Paul Nylen.
Identifiers: *Corrosion, *Steel, *Precipitation, *Air quality measurements, *Sweden, Urban areas, Harbors, Chemical composition, Sulfuric acid, Sulfur dioxide.

The paper presents an investigation of the rate of corrosion of unprotected steel exposed for eight years in the open air at 11 sites in Sweden. Data on the chemical composition of the atmosphere at these sites have been obtained by monthly analyses of the air and of rain or snowfall, pH values and conductivities being also determined in the latter cases. Two different types of steel have been investigated, hot-rolled mild steel with intact millscale, and after scale removal by grit blasting and cold-rolled steel of high carbon content. After a couple of years exposure, rust formation is equally severe on panels with and without millscale with one exception: in a marine atmosphere the panels with millscale rust more rapidly than blast-cleaned panels. In strongly aggressive atmospheres, cold-rolled steel rusts more slowly than hot-rolled. After seven years exposure the rusting in city atmosphere (Stockholm and Gothenburg) is more than twice as severe as in marine atmosphere (West-coast). The high corrosivity of present city atmosphere is probably due to the high content of sulphur dioxide and sulphuric acid. A part II will be presented that will analyze the correlation between corrosion of steel and different types of air pollution at the sites.
APTIC-18299

### STABILIZATION OF HALOHYDROCARBONS IN A PHOSPHATIZING BATH.

(Dupont de Nemours (E. I.) and Co., Wilmington, Del.) Brit. Pat. 969,108. 12p., Sept. 9, 1964. (Appl. Aug. 7, 1962, 17 claims).
Personal Author Not Recorded.
Identifiers: *Corrosion, *Phosphoric acid, *Halogenated hydrocarbons, *Quinones, Metal fabricating and finishing, Hydrochloric acid, Chlorinated hydrocarbons.

A phosphatizing bath containing a halohydrocarbon solvent, phosphoric acid, and a phosphoric acid solubilizing agent is described wherein there is incorporated a quinone as a stabilizing agent. Many stabilizers have been used during metal cleaning and degreasing operations to stabilize halohydrocarbons, particularly chlorohydrocarbons, against deteriorating effects of heat, light, and oxygen under alkaline or neutral conditions. In attempting to phosphatize metal surfaces in a halohydrocarbon-phosphoric acid solution, these solutions were unstable even in the presence of previously known stabilizing agents. The unique property of quinones of accepting relatively small quantities of hydrogen chloride in the presence of much larger quantities of phosphoric acid makes them outstanding stabilizers in chlorohydrocarbon phosphatizing solutions. In general, an amount between 0.001 and 1% by weight based on the amount of halohydrocarbon is preferred, although some stabilization occurs even when lower concentrations are employed. Corrosion of equipment in metal phosphatizing operations with phosphoric acid-chlorohydrocarbon solutions has been almost entirely eliminated by combining the quinones with nitrogen-containing aromatic compounds. The 'Zinc Dust Test' was devised to simulate the stabilizing action of various stabilizing agents in an anhydrous chlorohydrocarbon phosphatizing bath operating under actual phosphatizing conditions on metal surfaces. The measured result of the test is the amount of chlorides present in parts per million and is considered to vary proportionately with the degree of trichlorethylene decomposition and corrosivity potential resulting therefrom. An additional test was performed to determine the effect of quinones on the corrosion of stainless steel. The hydrogen chloride acceptance of quinone in the presence of phosphoric acid was also determined. Presence of a quinone in the phosphatizing bath dramatically increases the bath life for effective phosphatizing.
APTIC-22467

### INQUIRY INTO THE ECONOMIC EFFECTS OF AIR POLLUTION ON ELECTRICAL CONTACTS. (FINAL REPORT).

For primary bibliographic entry see Field 10.
APTIC-22755

### EARLY STAGES IN THE INTERACTION OF CARBON MONOXIDE WITH IRON SINGLE CRYSTAL FILMS.

Georgia Inst. of Tech., Atlanta, Chemical Engineering Dept., Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., July 1968, 390p. 169 refs.
James Titus Ratliff.
Identifiers: *Carbon monoxide, *Corrosion, *Iron, Economic losses, Petroleum production, Catalytic activity, Decomposition, Reaction mechanisms.

The early effects of the catalytic decomposition of carbon monoxide on iron surfaces are explored. Equipment and techniques for reproducibly growing thin, iron single crystal films are developed, and mechanisms to expose these clean surfaces to high purity carbon monoxide at controlled temperatures are designed. The economic losses resulting from metal dusting provide the motivation for this research. Carbon monoxide decomposes on the surface of a catalyst to give carbon dioxide and elemental carbon. This type of attack is common to the petroleum and related chemical industries dealing with high temperature carbonaceous environments. Electron microscopy offers the versatility required to explore this phenomenon. A mechanism is postulated to explain the early stages of the interaction. (Author summary modified)
APTIC-22810

### DEVELOPMENT OF A MOLTEN CARBONATE PROCESS FOR REMOVAL OF SULFUR DIOXIDE FROM POWER PLANT STACK GASES. PART III. MATERIALS STUDY.

Contract PH 86-67-128, N.A.R.C. Rept. AI-70-7, PR-2, 26p., 1968. 16 refs. CFSTI: PB 191959
Personal Author Not Recorded.
Identifiers: *Corrosion, *So2 removal (combustion products), *Carbonates, Steel, Stack gases, Steam plants, Scrubbers, Lithium compounds, Potassium compounds, Sodium carbonate, Carbon dioxide, Sulfates, Hydrogen sulfide, Sulfites, Water, Temperature.

The molten alkali carbonate eutectic consists of essentially equal parts by weight of lithium, sodium, and potassium carbonate. It may be used to control sulfur dioxide air pollution by scrubbing stack gases with the molten salt. The resultant fused salt contains sulfite which disproportionates to sulfate and sulfide. Suitable containment of these molten salts in water, carbon dioxide, and hydrogen sulfide gaseous environments is required for commercial development of this technique to control air pollution. The results of screening, medium-term and long-term static, dynamic, and thermal cycle tests are given. At 500 C, stainless steel (SS) 347 appears to contain all of the above melts satisfactorily. At 600 C, satisfactory containment of the melts with sulfur compounds present required low-iron, nickel- or cobalt-based alloys with about a 20% chromium content, while SS 347 satisfactorily contains the pure carbonate melt. At higher temperatures, containment of these melts requires high-chromium alloys, ceramics, cermets, or a frozen skull of the salt. Materials for a small pilot plant are recommended, and the future corrosion program is outlined. (Author abstract)
APTIC-23376

### CORROSION IN THE ATMOSPHERE.

(Korrosion i Atmosfar). Text in Swedish. Forsvarets Forskningsanstalt, Sundbyberg (Sweden), FOA 1, Rept. C 1333-92, 8p., Nov. 1969. 9 refs.
Per Atterby.
Identifiers: *Corrosion, *Sweden, Metals, Germany, Great britain, United states, Non-urban areas, Industrial areas.

About 80% of all metal constructions are exposed to air. A comparison between Germany, England, USA, and Sweden showed that in industrial areas, Sweden has about 1/2 and in rural areas about 1/4 of the other countries' corrosion velocity.
APTIC-23440

### CORROSION OF METALLIC MATERIALS BY DUST.

(Korrosion pa metalliska material genom stoft). Text in Swedish. Konf. Energi och Miljo, Kungalv, Sweden, 1969, no. 2:1-7, 1969. 29 refs.
E. Borje Bergsman, and Lars-Martin Liljenvall.
Identifiers: *Corrosion, *Chromium, *Dusts, Costs, Sweden, Non-urban areas, Urban areas, Oceans, Stack gases, Sulfur dioxide.

Both practical experience and laboratory experiments have shown that dust under certain conditions can be accompanied by corrosion of metallic materials. Sulfur dioxide and dust are for many materials a fateful combination. Experiments in Sweden showed that the urban atmosphere is four times more corrosive than suburban atmospheres and about twice as corrosive as marine atmospheres. These results come from long-term experiments. Chromium plated materials in rural atmospheres showed no damage after four years; but in urban atmospheres the surface was quite spoiled. The costs for corrosion due to the pollutants in urban districts have been estimated at about 200 million dollars per year for metallic materials only including corrosion on cars. This means that the corrosion cost per capita in urban areas is about 20 dollars a year.
APTIC-23448

### INFLUENCE OF REDUCING FLUE GASES ON THE CORROSION OF FURNACE TUBES.

(Einfluss von reduzierender
Rauchgasatmosphaere auf die Korrosion von
Brennkammerrohren). Text in German. Mitt. Ver.
Grosskesselbesitzer, 49 (3):180-182, June 1969. 3
refs.
A. Stoenner.
Identifiers: *Corrosion, *Stack gases, *Boilers, Germany, Carbon monoxide, Sulfur compounds, Reduction, Combustion.

The partial renovation of combustion chamber pipes of a forced-through-flow boiler carried out after 55 thousand working hours revealed a very good agreement with the results of the study of combustion processes by measurement of flue gases concentration in the atmosphere of combustion chamber of the boiler 6 years ago. The position of highest carbon monoxide concentrations found at that time coincided with the most corroded areas of the pipes. It was estimated that in the presence of 1.3% sulfur and 3-4% CO in the close neighborhood of the tube wall, the rate of wall thinning was .6 mm 110 to the fourth power hours. The economic aspects of the necessity of partial changing of combustion chamber pipes are considered.
APTIC-23460

### ESTIMATION OF THE BREAKDOWN POSSIBILITIES OF THE OUTDOOR HIGH VOLTAGE INSULATORS BY THE MEASUREMENT OF THE PROPERTIES OF POLLUTION.

Ocena stopma zagrozenia izolacji napowietrznei
wysokiego napiecia przez pomiary parametrow
osadow). Text in Polish. Przegl. Elektrotech., 42
(7):272-273, 1966. 14 refs.
Zbigniew Pohl.
Identifiers: *Insulators, *Deposition, *Measurement methods, Materials deterioration, Europe, Voltage.

The factors characterizing performance and quality of high voltage insulators are considered and methods of their estimation and measurement are reviewed and discussed. Measurement is considered with respect to conductivity of pollution deposits on insulators, and resistance of insulator material. A special 'knife' electrode is described enabling simple measurement of conductivity of deposits on insulators. It is also suitable for study of insulators with protective coatings.
APTIC-23463

### CORROSION ASPECTS OF AIR POLLUTION.

Am. Paint J., vol. 39:64-78, 1955. 15 refs.
(Presented at the National Association of
Corrosion Engineers, Northeast Regional
Meeting, New York, May 10, 1955.)
Leonard Greenburg, and Morris B. Jacobs.
Identifiers: *Corrosion, Construction materials, Leather, Metals, Rubber, Furface coatings, Textiles, Non-urban areas, Industrial areas, Oceans, Microorganisms, Oxidants, Meteorology, Winds, Humidity, Rain, Temperature (atmospheric), Stability (atmospheric), Inversion, Acids, Ammonium compounds, Chlorides, Sulfur dioxide, Oxygen, Sulfates, Oxidation.

The relative order of increasing corrodibility of atmospheres is rural, tropical, tropical-marine, urban, marine, industrial-marine, and industrial. Corrosive agents can be placed into four major categories: oxygen and oxidants, acidic materials, salts, and alkalies. Damage attributable to oxygen is deemed to result from the solution of oxygen by a thin film of liquid adjacent to the metallic surface, the transportation of the oxygen through the film, and the subsequent reaction at the surface of the metal. The total acidity of the atmosphere is closely related to the sulfur dioxide content. Some salts such as ammonium sulfate and ammonium chloride have a corrosive action which is attributable actually to the acid produced in their hydrolysis. While a number of metals are relatively resistant to acid attack, they have an emphoteric action and can react with alkali. For example, aluminum and zinc are in this category. Building materials, textiles, leather, rubber, and protective coatings are affected as well as metals. Weather inversions and isothermal conditions cause air stagnation and consequently an increase in the concentrations of air pollutants. The effects of rain, humidity, temperature, and wind are also discussed. Mechanisms of corrosion due to microorganisms such as bacteria are mentioned.
APTIC-23490

### CORROSION OF METALS BY ACID VAPOURS.

Royal Armament Research and Development
Establishment, Fort Halstead (England), Basic
Techniques Div., M-5/70, 10p., March 1970.
CFSTI, DDC: AD 703572
P. D. Donovan, and J. Stringer.
Identifiers: *Corrosion, *Metals, *Organic acids, Adhesives, Plastics, Paints, Textiles, Wood, Great britain, Acetic acid, Formic acid, Vapors.

Organic acid vapors may be evolved in trace quantities from a wide variety of organic materials. If such sources are held in confined spaces with metals, significant levels of vapors build up which, at high humidities, may cause rapid corrosion. Based on a simple test developed for vapor corrosion, the sources of organic acid vapors encountered viz. woods, fabrics, paints, adhesives, and certain plastics are discussed and the types of vapors evolved from many of these are identified. Methods of reducing the quantities of acids evolved are considered. The action of a wide range of concentrations of acetic and formic acids on a variety of metals is reported. Zinc and cadmium, the metals most frequently used as protective coatings, are among the most susceptible to this form of attack; steel, magnesium, and lead are also rapidly corroded. Copper, brass, and nickel are less rapidly attacked and tin, aluminium, and silver are resistant. A wide range of alloy electrodeposits was studied for their susceptibility to this type of corrosion; the most protective coatings for steel against atmospheric and vapor corrosion effects were nickel/zinc, tin/cadmium, manganese/selenium, and a duplex coating of tin over cadmium. The practical implications, particularly in packaging, are considered. (Author summary modified).
APTIC-23551

### FUNDAMENTAL DEGRADATION PROCESSES RELEVANT TO OUTDOOR EXPOSURE OF POLYMERS.

Appl. Polymer Symp., no. 4:41-59, 1967. 21 refs.
H. H. G. Jellinek.
Identifiers: *Reaction kinetics, *Cracking, *Synthetic rubber, Eye irritation, Esters, Polynuclear compounds, Nitrogen dioxide (no2), Sulfur dioxide, Oxygen, Ozone, Oxidation, Photolysis, Solar radiation.

Sunlight, oxygen, and various gases in the atmosphere such as ozone, nitrogen dioxide, and sulfur dioxide contribute to the deterioration of polymers. A survey is presented of the fundamental reactions which can take place when polymers are exposed, separately, to light and oxygen. The kinetics of chain scissioning and crosslinking are presented in detail. Oxidation is discussed on the basis of Bolland's mechanism. The pure photolysis of polymers is considered. A number of examples are given in order to illustrate the discussion. The simultaneous effect of light and oxygen is illustrated by considering poly- (ethyl acrylate). The effects of ozone and other air pollutants, specifically rubber cracking and eye irritation, are discussed. (Author abstract modified)
APTIC-24054

### REACTION BETWEEN SO2 AND WET METAL SURFACES.

Corrosion Sci., 10 (1):43-49, Jan. 1970. 5 refs.
Nils-Gosta Vannerberg, and Tomas Sydberger.
Identifiers: *Corrosion, *Iron, *Sulfur dioxide, Aluminum, Copper, Zinc, Sweden, Electroconductivity analyzers, Sulfuric acid, Hydroxides, Oxides, Oxygen, Water, Vapors, Reaction mechanisms.

The drastic corrosion of iron in an atmosphere containing sulfur dioxide has been shown to be due to the catalytic effect of Fe oxides and hydroxides on the formation of sulfuric acid from SO2, water and oxygen. Measurements performed on samples of Fe and rust in an atmosphere containing water vapor, O2 and SO2 at 95 plus or minus 1 C indicate an almost quantitative oxidation of adsorbed SO2 to H2SO4. Experimental apparatus comprised a round-bottomed flask containing 500 ml of distilled water in which a conductivity measuring cell was immersed. Measurements carried out on copper and aluminum showed a somewhat faster increase in the conductivity; initially, a relatively rapid increase was also obtained for zinc, but the change in conductivity decreased rapidly with time. Much more rapid changes in conductivity were obtained for samples of Fe, rust and stainless steel. Since the proton concentration is considerably higher than the metal ion concentrations and, furthermore, the equivalent conductivity of the proton is much higher than those of metal ions, it follows that the conductivity is directly proporational to the proton concentration. This is not, however, the case for Zn where a comparatively high concentration of Zn ions and a higher pH are obtained in the solution. (Author abstract modified)
APTIC-24129

### CORROSION-RESISTANT LOW-ALLOY STEELS: A REVIEW WITH PARTICULAR REFERENCE TO ATMOSPHERIC CONDITIONS IN THE UNITED KINGDOM.

Brit. Corros. J., 5 (1):24-32, Jan. 1970. 158 refs.
K. A. Chandler, and M. B. Kilcullen.
Identifiers: *Steel, *Great britain, *Corrosion, Chromium, Copper, Manganese, Molybdenum, Nickel, Phosphorus compounds, Silicon compounds, Oxidation.

The addition of comparatively small amounts of certain alloying elements to mild steel results in a considerable reduction of corrosion under certain conditions of exposure to air. The literature on the effects of small alloy additions to mild steel is reviewed. It is noted that the addition of about 0.2% copper to mild steel markedly reduces corrosion. Other beneficial alloying elements are phosphorus (at levels of about 0.06%) and chromium (at levels above 1%). Both these elements are most effective in combination with copper. Nickel may be effective in tropical environments and molybdenum an effective alloying addition in British environments. Evidence for the effect of silicon and manganese is not conclusive. Also reviewed are papers dealing with the effects of design on the performance of low-alloy steels, the painting of these steels, and the theoretical background of their enhanced corrosion resistance. Effects of orientation may be of major importance for the corrosion behavior of the low-alloy steels. In some situations, these steels

require painting, and there is evidence that paint performs better on them than on unalloyed steels. Although the corrosion-resistance properties of copper-containing steels are not fully understood, the presence of copper does give colloids a denser structure; this may be relevant to protective rusts.
APTIC-24133

### CHAIN SCISSION OF POLYMERS BY SMALL CONCENTRATIONS (1 TO 5 PPM) OF SULFUR DIOXIDE AND NITROGEN DIOXIDE, RESPECTIVELY, IN PRESENCE OF AIR AND NEAR ULTRAVIOLET RADIATION.

J. Air Pollution Control Assoc., 20 (10):672-674, Oct. 1970. 14 refs.
H. H. G. Jellinek.
Identifiers: *Chain scission, *Polymers, *Materials deterioration, Plastics, Synthetic rubber, Nitrogen dioxide (no2), Sulfur dioxide, Ozone, Chemical reactions, Ultraviolet radiation.

Results are presented as to the extent of chaim scission (crosslinking) suffered by various polymers exposed to 1 atm of air and near ultraviolet light (Lambda greater than 2800 A) in the presence and absence of nitrogen dioxide, sulfur dioxide, and ozone, respectively, in concentrations from 1 to 5 ppm. Vinyl polymers are scarcely affected by $SO_2$ and $NO_2$, but nylon and elastomers are quite sensitive toward these gases. Elastomers are also extremely sensitive to ozone. These conclusions agree with observations reported in the literature on tensile tests, elongations, flexibilities, and infrared measurements in the presence of sulfur dioxide under similar conditions. (Author abstract modified)
APTIC-24140

### A NEW METHOD OF TREATMENT OF SULFUR DIOXIDE ABSORBING SOLUTION.

For primary bibliographic entry see Field 02.
APTIC-24160

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## 10. ECONOMIC ASPECTS

### THE FLUORINE CONCENTRATION OF PLANTS.

For primary bibliographic entry see Field 08.
APTIC-18266

### NORTHERN AND CENTRAL USES THE ARC CYCLE.

Can. Petrol., no. 9:46-50, Sept. 1968.
Jeff Elliot.
Identifiers: *Liquefaction, *Natural gas, *Compressed gases, Costs, Canada, Design criteria.

Two new liquefaction and storage plants for natural gas will enable Canada's Northern and Central Gas Corporation to deal more economically with the winter peak demand periods within the existing supply and rate structure. Both plants will use Air Liquide's patented ARC cycle. The larger of the two plants will cost between five and six million dollars and will have a daily liquefaction capacity of 10 MMcf. There will be storage facilities for 1100 MMcf in each of the two tanks. In contrast, the smaller plant will cost 3.5 million dollars, have a liquefaction capacity of 2.5 MMcfd, be able to vaporize 45 MMcfd, and will store 600 MMcf in one above ground tank. The fact that water seepage has been a major problem to American plants using underground facilities led the company to select double-walled above ground tanks. Through the liquefaction facilities the company will save money in gas purchase costs, be forced to buy less unneeded gas, and keep its average daily intake above 90% (maintaining a low Mcf rate). It is noted, however, that the company's growth is contingent on future gas supplies.
APTIC-22255

### NEW STEEL DESIGN CONCEPTS FOR LIQUEFIED NATURAL GAS STORAGE.

Proc. Am. Gas Assoc. Operating Section Conf. 1962, CEP-62-15, 3p. (Presented at the Am. Gas Assoc. Operating Section Conf., 1962.)
R. M. Stuchell, and L. R. Werninck.
Identifiers: *Methanes, *Compressed gases, *Costs, *Storage facilities, Aluminum, Steel, Nickel, Natural gas, Design criteria, Liquids.

As suggested by a review of the literature, liquid methane can be stored with maximum safety in conventional aboveground storage tanks provided with adequate diking. Cost data show that for tanks below 45,000-barrel capacity, aluminum is more economical for inner tank construction; above the 45,000-barrel capacity, economics dictates the use of 9% nickel steel for the inner tank. For a 60,000 barrel tank, the cost of the 9% nickel steel will amount to 41% of total tank cost, while the cost of a carbon steel outer shell will amount to about 17 1/2%. Other tank costs involve the insulating materials. The powdered insulation in the roof and in the annular space between the shells is 1.8 and 6.2% of total cost, respectively. Costs are also influenced by storage tank dimensions. Between the 20,000-barrel capacity and the 130,000-barrel capacity, the most economical diameter-to-height ratio is of the order of 1.5. As capacities increase above 130,000 barrels, this ratio approaches 2.5. New design concepts that offer possibilities of reducing the costs of tank construction by 10% involve reduction in the thickness of the inner tank bottom plate, reduction in the thickness of load-bearing insulation, and the elimination of the conventional inner-tank roof.
APTIC-22314

### SULFUR THAT GETS AWAY.

For primary bibliographic entry see Field 02.
APTIC-22397

### HERE'S WHAT $SO_2$ REMOVAL COSTS.

Hydrocarbon Process., 46 (7): 161-164, July 1967. 7 refs. (Presented before the American Association of Cost Engineers, Cleveland, Ohio, July 11, 1967.)
Sidney Katell, and K. D. Plants.
Identifiers: *Costs, *So2 removal (combustion products), Stack gases, Steam plants, By-product recovery, Catalytic oxidation, Alkalized alumina, Reinluft process (absorption).

From pilot plant tests, capital and operating costs are estimated for three methods of removing sulfur dioxide from power plant stack gases: the Reinluft process using activated char; the alkalized alumina process; and the catalytic oxidation process. The second of these was calculated to have the lowest capital investment and operating costs. Credit for byproduct recovery is discussed, and cost factors for other processes, including a Japanese catalytic oxidation system and methods using dolomite, limestone, or phosphate rock are briefly reviewed.
APTIC-22444

### INQUIRY INTO THE ECONOMIC EFFECTS OF AIR POLLUTION ON ELECTRICAL CONTACTS. (FINAL REPORT).

Stanford Research Inst., Menlo Park, Calif., NAPCA Contract PH-22-68-35, SRI Proj. PSU-7345, 97p., April 1970. 514 refs. CFSTI: PB 192478
Robert C. Robbins.
Identifiers: *Economic losses, *Electrical contacts, *Corrosion, Metals, Hydrocarbons, Sulfur oxides, Hydrogen sulfide.

Problems of economic significance caused by air pollution in the utilization and operation of electrical contacts and other electrical devices are discussed. Prevention of contact failure in low voltage contacts is the largest problem area. Sulfur gases are primarily responsible for the deleterious effect on these contacts. One form of protection against sulfur gases is the use of air conditioning and air purification systems. Another kind of protection is precious metal plating. Hydrocarbon vapors will polymerize on palladium, causing an insulating film. Gold-plated silver contacts react with hydrogen sulfide, causing an electrical failure. The cost related to failure of electrical devices caused by air pollution for 1968 is estimated to be about $64 million in the United States. Industry does not know the amount of air pollution reduction needed to appreciably reduce the damaging effects on electrical contacts. (Author summary modified)
APTIC-22755

### THE IMPACT OF AIR POLLUTION CONTROL ON THE ECONOMICS OF ENERGY SUPPLY.

Proc. Am. Power Conf., vol. 27:103-107, 1965.
Abraham Gerber.
Identifiers: *Socio-economic factors, *Coal, *Electric power production, Nuclear power plants, Steam plants.

For the large consumer of fuel, the cost of controlling the effluent of the products of combustion relative to the total cost of fuel is less than it is for the small consumer, so that effective control measures are more likely to be adopted by the large consumer. However, a given quantity of fuel burned by a large number of small consumers is likely to have a much greater impact on the environment than a similar quantity of fuel burned by a relatively few large consumers. In some cases, such as power plants, the products of combustion are emitted at relatively high effective altitudes and dispersed in the upper atmosphere, while in other cases, such as the automobile or small residential, commercial and industrial establishments, the effluent is emitted at ground level. The ability to substitute one fuel for another in a wide range of uses has resulted in competitive pressure on all fuels to develop the technology that has made possible low cost. Air pollution regulations, especially as they now most frequently appear to be conceived, and based primarily on limitations with respect to the chemical composition of the fuel to be burned, tend to eliminate that desirable competition. Restrictions on the use of coal for electric generation would have the most serious detrimental impact not only on the coal industry--the owners of coal resources and the miners of coal--but would severely impair the economic welfare of important regions of the country. The entire Appalachian region from Pennsylvania to Alabama, as well as the midwest coal region of Illinois, Indiana and western Kentucky, would suffer such adverse economic effects. Even optimistic projections of the rate of progress of nuclear power from its present position with only about 1 and l/2 million kilowatts of capacity, to the FPC projection of 70 million kilowatts by 1980, still leaves us with the need for something in the neighborhood of 800 million tons of coal equivalent to be provided by the fossil fuels.
APTIC-23511

### EXPENDITURE AND PERFORMANCE OF VARIOUS PROCESSES FOR DUST CONTROL --A COST EVALUATION.

Staub (English translation from German of: Staub, Reinhaltung Luft), 30 (3):23-28, March 1970. 12 refs. (Presented at the International Dust Colloquium, 9th, Paris, France, Nov. 26-28, 1969.)
Lothar-Hans Engels.
Identifiers: *Costs, *Dusts, *Control equipment, Germany, Operating variables, Particle size, Collectors, Electrostatic precipitators, Filters, Scrubbers.

The selection of dust control equipment is discussed first in terms of particle sizes of various industrial dusts. The discussion is illustrated by a chart showing the sizes of dusts from different industrial processes; ranges of dust concentrations in the atmosphere and in working environments; and finally the separation characteristics of mechanical, wet, filter, and electrical separators

as a function of particle size. While there are opportunities for improvement within the limits indicated by the chart, the attainment of better performance often affects space and power requirements. Space requirements for each type of collector are shown in cu m per 1000 cu m gas cleaned per hr, and power costs as a function of throughput (cu m/hr) and total pressure drop of the system. A correction factor for market and competitive conditions is included for evaluating prime costs as a function of throughput. It is emphasized that data on investment costs must be supplemented by comparative costs of the construction volume, the operational costs, the spare parts requirements, and interest charges. Total costs of the different collectors (at a throughput of 100,000 cu m/hr and 80,000 hr) for a 10-yr period are indicated in a graph. The importance of dust collection processes for the general economy is shown in a chart of the turnover in industries manufacturing dust collection devices.
APTIC-23716

### ECONOMIC IMPACT OF AIR POLLUTION CONTROLS ON THE SECONDARY NONFERROUS METALS INDUSTRY.

Washington, D. C., U. S. Government Printing
Office, 1969, 24p. 12 refs.
Personal Author Not Recorded.
Identifiers: *Costs, *Primary metallurgical processing, Enforcement procedures, Federal governments, Local governments, State governments, Legislation, Regulations, Operating variables, Electrostatic precipitators, Bag filters, Scrubbers.

An estimation of the economic impact of gas cleaning systems, currently required by state and local laws and regulations, on the secondary nonferrous metals industry is presented. This industry is primarily engaged in recovering nonferrous metals and alloys from scrap. The three principal systems of air pollution control equipment available to this industry are the dry baghouse, electrostatic precipitator, and wet scrubber. Investment trends, cost considerations, and cost burden analyses for a variety of combinations of control equipment and industry size are presented. The types of control equipment are described as they apply to different furnaces, fuels, and incinerators. Operating variables that can affect the performance or cost of the equipment are mentioned. Federal and local laws and regulations and their enforcement procedures are described.
APTIC-23742

### COST-BENEFIT ANALYSIS OF THE U. S. BREEDER REACTOR PROGRAM.

WASH 1126, 98p., April 1969. 30 refs.
Personal Author Not Recorded.
Identifiers: *Costs, *Reactors (nuclear), *Nuclear power sources, Fuels, Coal, Mathematical analyses, Uranium compounds.

Eight groups of calculations with a total of 36 cases were performed to investigate the effects of varying parameters on benefits accrued from an economy with a breeder reactor as compared to an economy without a breeder. These assumptions relate to uranium fuel costs, fossil fuel costs, electrical energy demands, electrical energy costs, and timing of the introduction of the breeder. Each group consists of a base case without a breeder compared to cases with a breeder represented by the Liquid Metal-Cooled Fast Breeder Reactor (LMFBR). Some cases cover a parallel breeder program. The benefits of introducing the breeder in different years were determined by comparison with the base case without a breeder. The four parameters studied included the introduction date of the breeder, the cost of uranium, the cost of fossil fuel, and the energy demand. Four groups provide a measure of how varying energy demands affect benefits for assumed rising uranium costs and constant fossil fuel costs. Other groups provide a measure of how varying energy demands affect benefits for constant $8 per pound uranium costs and constant fuel costs. Another group examines a set of cases for rising uranium and rising fossil fuel costs with a base energy demand. Results of the analysis clearly support the development of the breeder in accordance with the current planning schedule. Success of the breeder program would in the not too distant future provide access to virtually limitless sources of electricity at a low cost, assurance that low-cost uranium ore reserves will be efficiently used, and the virtual elimination of air pollution from nuclear-fueled electrical power plants.
APTIC-23756

### STUDY OF COST OF SULPHUR OXIDE AND PARTICULATE CONTROL USING SOLVENT REFINED COAL.

General Technologies Corp., Reston, Va.,
NAPCA Contract CPA 22-69-82, 68p., April 1970.
26 refs. CFSTI: PB 193420
Robert G. Shaver.
Identifiers: *Costs, *Solvent refining (low ash), Coal, Electric power production.

Cost analysis data are presented for the solvent refined coal (SRC) process in order to facilitate comparison of this method of sulfur oxide control with competing methods. The SRC process, by treatment of coal prior to combustion, produces a fuel that is water-free, low in sulfur, very low in ash, has a melting point low enough to allow it to be transported as a fluid, and, regardless of the grade of coal used has a heat content of 16,000 Btu/lb, thus lowering shipping costs on an equivalent thermal basis. The potential market for SRC is difficult to predict largely because its use requires a long-term commitment on the part of producers to process it and on the part of the users, primarily the electric power utilities, to consume it. A level of production necessary for economy requires this. However, the potential benefits of the use of the SRC process rather than a combustion gas treatment process are great, and the special characteristic that allows a minimized combustion plant investment ensures that SRC combustion units, as they age and are changed from base load toward intermittent load use, will be on a much sounder financial basis than those that have combustion gas treatment equipment added on. A processing cost of no more than 10 cents/MMBtu to convert bituminous coal to SRC should allow price-competitive access to over 60% of the current bituminous coal-fired combustion unit market. (Author summary modified)
APTIC-23800

### POLLUTION: THE COST TO INDUSTRY.

Mod. MFG., vol. 10:163, Oct. 1970.
Personal Author Not Recorded.
Identifiers: *Abatement, *Costs, *Industrial emission sources, Chemical processing, Food and feed operations, Metal fabricating and finishing, Paper manufacturing, Primary metallurgical processing, Rubber manufacturing, Textile manufacturing.

The results of a survey relating industrial groups to expenses and efforts directed toward air pollution control are discussed. The information tells what plants in various industries are spending, and indicates what they will be spending in the future. Some primary metal plants, for example, are spending as little as 1% of their manufacturing cost on pollution control while other plants in the same industry are spending 20%. Specific categories discussed include primary metal plants, metal fabrication, machinery, foods, chemicals, rubber and plastics, paper, textiles, electrical, and transportation equipment. With the data given it is possible to compare one plants efforts with those of similar plants in the industry.
APTIC-23842

### SHOW AND TELL.

Iron Steel Engr., 47 (7):59-65, July 1970. (Presente
at the American Iron and Steel Institute General
Meeting, 78th, New York, May 27-28, 1970.)
Reynold C. MacDonald.
Identifiers: *Abatement, *Costs, *Steel, *Primary metallurgical processing, Administration, Socioeconomic factors, Social attitudes.

By the end of 1970, steel companies will have spent more than $1,000,000,000 in the past 20 years on environmental control equipment. But even this has not been enough to restore the balance of nature or to deflect criticism of the industry. To meet these challenges, steel companies must demonstrate a continued willingness to attack pollution, each company organizing for pollution control activities as it does for other important company functions. The industry must also accelerate its own research and development programs on control equipment and techniques. Chances are that costs can be minimized and efforts maximized if these activities are coordinated in the future. However, the cost of technology that can reduce pollution to measurable proportions will be considerable; it will not be diminished by slowing down production or the American economy. The consequences of such an action would create higher prices, more unemployment, and a reduced standard of living. Hopefully, once it is informed of these consequences, the public will be willing to pay the bill for environmental quality.
APTIC-24155

## 11. STANDARDS AND CRITERIA

### SYNERGISM BETWEEN FLUORINE EMISSION AND OTHER AIR POLLUTANTS.

For primary bibliographic entry see Field 03.
APTIC-18283

### EXHAUST GASES FROM GASOLINE POWERED VEHICLES.

For primary bibliographic entry see Field 01.
APTIC-18294

### AIR POLLUTION AND DISTRICT HEATING.

For primary bibliographic entry see Field 01.
APTIC-18295

### DUST MEASUREMENT AND STANDARDS.

For primary bibliographic entry see Field 03.
APTIC-22177

### THE VALIDITY OF THE SOVIET MIK-VALUE FOR LEAD.

(Die Begruendung des sowjetischen MIK-Wertes
fuer Blei). Text in German. Arch. Hyg. Bakteriol.
(Munich), 152 (1):93-96, 1968. 6 refs.
D. Stoefen.
Identifiers: *Maximum allowable concentration, *Ussr, *Lead compounds, Epidemiology, Thresholds, Germany.

The Soviet MIK value for lead was fixed on the basis of a study published in 1952. It was aimed at avoiding lead accumulation in the organism. Considerably fluctuating figures concerning the lead balance must be used. Subsequent reflexological and physiological tests were published in 1960 and 1961 respectively. In animal tests, 0.00278 and 0.0025 mg/cu m lead dust (daily mean value) were found, as well as changes in the period of latency to optical and acoustical stimuli, changes in the motor reflexes, and coproporphyrin excretion and morphological changes in the cerebrum and the spinal cord. Children had a considerably increased coproporphyrin excretion at a daily 8-hour lead exposure of 0.00102 mg/cu m in the vicinity of factories. The Soviet MIK value for lead (0.0007 mg/cu m) is confirmed; the Soviet MAK value for lead (0.01 mg/cu m) is fixed too high. (Author abstract modified)
APTIC-22223

### TESTING FILTER MEDIA.

Instr. Control Systems, 35 (4):111-112, April 1962.
Fritz Rosenthal.
Identifiers: *Carbonyl iron, *Neutron activation analysis *Filters, *Gamma radiation, Iron.

A new method for testing filters is based on the conversion of carbonyl iron particles into their radioactive form by neutron activation. Radioactive properties of the iron include penetrating gamma radiation suitable for remote detection and with a half-life of 45 days. In the test procedure, carbonyl iron particles are suspended in motor oil and the oil is passed to the test section where the filter is mounted. Radioactivity of the iron collecting on the filter is then monitored by a scintillation detector mounted below the test section and connected to a scaler or monitor. The readings obtained provide the desired information about filter quality. When oil temperatures, flow, viscosity, and particle size are kept constant, each type of filter gives a characteristic cumulative count of radioactivity with time. This count rate permits the simple calculation of the weight of iron on the filter paper at any time. Simultaneously, the pressure due to clogging of the film is recorded. Due to the high degree of sensitivity of the radioactive count, differences in initial filter retention are detected which escape unnoticed by conventional procedures. These differences are emphasized when the retentions are plotted against a logarithmic time scale.
APTIC-22242

### AIR POLLUTION CAUSED BY HEATING PLANTS; PROPOSAL FOR A NEW INDEX ON WHICH TO BASE EMISSION LIMITS.

(Inquinamento atmosferico da impianti termici; proposta di un nuovo indice di riferimento per i limiti alle emissioni). Text in Italian. Riv. Combusti., 21 (10):501-505, Oct. 1967. (Presented at the Associazione Termotecnica Italiana, 22nd National Congress, Rome, Sept. 27-29, 1967.)
C. Padovani, and P. Capponi.
Identifiers: *Emission standards, *Heating plants, Criteria, Italy, Fly ash, Smokes, Coal characteristics, Mathematical analyses, Carbon dioxide, Carbon monoxide.

An index is obtained by dividing the weight of solid particles in waste gases, expressed in grams per cubic meter of dry smoke, by the % volume of carbon monoxide and multiplying by 100. This can be used in calculating the tolerance limits, by assigning a ceiling value of this index based on the carbon content of the fuel and on the heating plant capacity. Previous reference standards include that of the Kommission Reinhaltung der Luft (West Germany, November 1961), which sets maximum dust content on the basis of a graph derived from total ash content of fuel used; that of the Ministere de la Sante Publique (France, October 1964), which bases dust and sulfur dioxide limits on total heat output in Mcal; that of the Department of Health, Education and Welfare (USA, May 1966), also based on a curve of heat output. The weakness of the earlier proposals is that they not only require direct measurement of the amount of fuel burned but also an evaluation of the total output of waste gases. A proposal is also made for establishing a carbon monoxide limit, based on the ratio of carbon monoxide to carbon dioxide. For plants with an output of Gcal/hour, the limit proposed would be a maximum of 20 liters of CO per cubic meter of CO2, assuming standard conditions of temperature and pressure. For plants with an output of 1 Tcal/hour, the ratio would be 10.
APTIC-22248

### CROSS SECTION OF CHIMNEYS THAT FORM A PART OF RESIDENTIAL STRUCTURES.

(La sezione dei camini incorporati in edifici di abitazione). Text in Italian. Riv. Combusti., 21 (10):521-527, Oct. 1967. (Presented at the Associazione Termotecnica Italiana, 22nd National Congress, Rome, Sept. 27-29, 1967.)
P. Capponi.
Identifiers: *Equipment standards, *Domestic heating, *Stacks, Italy, Smokes, Coal, Furnaces, Oil burners, Height finding, Mathematical analyses, Temperature.

An administrative regulation for the implementation of the Italian air pollution law of July 13, 1966, makes use of Sander's formula for calculating chimney cross sections, which in turn is a simplification of Redtenbacher's empirical formula, devised on the basis of coal grate furnaces used to heat the relatively small 19th-century structure. The first-mentioned formula somewhat oversimplifies the older one by replacing a nonconstant coefficient (1/n) with a constant k, equating this with 0.03 for grate furnaces and with 0.024 for oil heaters. The regulation makes allowance for the fact that heating plants with a capacity of more than 1000 Mcal/hour must be handled 'with some method of calculation that takes account of effective load losses' and of 'the more unfavorable meteorological conditions' that exist in some communities. A way of solving this difficulty is to return to the older formula, using a Cartesian diagram to evaluate the coeficient 1/n in terms of chimney height and heater capacity. A second degree equation is proposed, by means of which one can readily calculate the permissibility of smoke temperature for a given quantity of excess air and a given relative load loss. The same equation can be used to calculate maximum acceptable excess air or maximum load loss for a given minimum smoke temperature.
APTIC-22249

### THE LIMITS OF SULFUR DIOXIDE EFFECTS UPON PLANTS.

For primary bibliographic entry see Field 08.
APTIC-22280

### CRITERIA FOR COMMUNITY AIR QUALITY.

Tenn. Ind. Hyg. News, vol. 25:4-8, 1968. 2 refs. (Presented at the Tennessee Valley Industrial Health Conference, Gatlinburg, Sept. 19, 1968.)
A. D. Brandt.
Identifiers: *Air quality criteria, *Air quality standards, Area emission allocations.

Criteria provide the basis for setting ambient air quality standards, referring to effects to be expected from certain exposures to air pollutants. Factors to be considered in the adoption of standards are briefly discussed. They include the types of effects (health, plant and property damage, aesthetics, visibility, and annoyance), existing air quality, land use, meteorology, and least cost benefits. Standards, which should be set on an air basin or air shed basin, have tended to fall into two categories: those representing concentrations of specific pollutants that are not to be exceeded, and those defining the level of air pollution considered acceptable to the area to which they apply. Air quality standards of a different form are currently under consideration by Pennsylvania and its neighboring states to avoid major pollution episodes. Designated 'Air Pollution Alert-Warning Systems', these standards establish three different levels -- alert, warning, and emergency -- based on a combination of existing meteorological conditions and forecast. For each level, programs will be developed to reduce the continuing build-up of the pollutant.
APTIC-22312

### INCINERATOR STANDARDS.

J. Air Pollution Control Assoc., 12 (10): 487-491, Oct. 1962. (Presented at the Air Pollution Control Association, 55th Annual Meeting, Chicago, Ill., May 20-24, 1962.)
Edward M. Voelker.
Identifiers: *Incineration, *Equipment standards, Combustion products, Design criteria, Mathematical analyses, Costs.

The Incinerator Institute of America, a non-profit organization formed in 1950, has established standards with the aim to up-grade the services and products of their industry to meet the demand for efficient nuisance free disposal of combustible waste. If the space around the incinerator is inadequate, if there is insufficient air supply to the incinerator room, or if the stack or draft producing equipment is inadequate, then the best designed incinerator will not operate nuisance free. As the Incinerator Standards have purposely dealt only with basic incinerator designs, the designing architect and engineer are asked to give careful consideration to the following: collection and method of changing the refuse; ample areas for charging, stoking, and ash handling, as well as general maintenance; adequate air supply; the effect which any air conditioning or ventilating equipment may have on the air supply; adequate draft to assure safe operation and complete combustion at reasonable temperatures; location of the top of the chimney or stack; immediate environments and the use of auxiliary equipment such as fly ash collectors; and current local codes and ordinances. Methods for determining the products of combustion from the burning of refuse are described: one procedure is to calculate the amount of theoretical and excess air based on ash and moisture free combustibles; the other method is to figure the theoretical and excess air requirements from the ash and moisture free combustibles, figuring separately the lb of dry gas, and to multiply to obtain the volume of dry gas. Water is figured separately and multiplied by the specific volume of water vapor at the temperature desired, and all the volumes are added together for a total figure. Cost considerations for incinerator design are also discussed.
APTIC-22375

### DISCHARGE LIMITATION FOR REFUSE INCINERATORS. (FWDP 12). APPENDIX C.

For primary bibliographic entry see Field 01.
APTIC-22389

### PRESENT AND FUTURE EMISSION STANDARDS FOR HEAVY-DUTY VEHICLES.

Preprint, Society of Automotive Engineers, Inc., New York, 5p., 1969. 4 refs. (Presented at the National Combined Fuels and Lubricants and Transportation Meetings, Houston, Tex., Nov. 4-7, 1969, Paper 690765.)
John A. Maga, and G. C. Hass.
Identifiers: *Emission standards, *Vehicles, Federal governments, State governments, Legislation, California, Engine exhausts, Gasolines, Internal combustion engines, Diesel engines.

From the initial motor vehicle emission standards that pertained only to exhaust of hydrocarbons and carbon monoxide, the California laws have gradually expanded control of all types of pollution from automobiles. Whereas pioneer legislation applied to all types of vehicles, significant changes in the laws now set up separate standards for light and heavy duty vehicles and for engines using gasoline and diesel fuels. The history and status of present California and federal emissions standards for heavy duty vehicles are reviewed and possible future development in this particular vehicle class is discussed. (Author abstract modified)
APTIC-22450

### PROPOSED INDUSTRY STANDARD FOR ELECTRIC POWER SUPPLIES USED WITH INDUSTRIAL GAS PROCESSING PRECIPITATORS.

Preprint, Inst. of Electrical and Electronics Engineers, New York, 7p., 1956. 8 refs. (Presented at the American Institute of Electrical Engineers, Winter General Meeting, New York, Jan. 31, 1956, Paper 56-337.)
J. W. Farr, and G. R. Monroe.
Identifiers: *Equipment standards, *Electrostatic precipitators, Electric power production.

Standards are provided for electric power supply equipment used with industrial gas processing precipitators; the equipment generally will consist of a rectifier transformer, one or more filament transformers when needed, rectifying components, and control or current-limiting components. Definitions and terminology are given. Temperature and altitude service conditions are

listed, as well as the terms in which rating shall be expressed. The standard frequency and limits of temperature rise are included. Control equipment, transformer losses and exciting current, dielectric tests, test procedures, terminal markings, and nameplates are also mentioned.
APTIC-22552

### GUIDELINES FOR ENVIRONMENTAL PROTECTION FOR KEEPING ANIMALS.

(Riktlinjer for miljoskyddande atgarder vid
animalieproduktion). Text in Swedish. Pub.
1970:3, 12p., 1970.
Personal Author Not Recorded.
Identifiers: *Operating criteria, *Slaughterhouses, Planning and zoning, Seasonal, Hogs, Poultry, Sweden, Fertilizing.

Guidelines are presented for animal farms with space for 1000 pigs or 10,000 poultry for slaughter. The recommended minimum distance from any settlement for these farms is 500 m. The handling of wet manure should be managed in special storage tanks, and the spreading of the manure should be done during the spring and autumn with a maximum of 50 t/hr. Manure spreading on holidays should not be permitted. A continuing control of water recipients is necessary.
APTIC-23438

### RATIONAL STANDARDS OF HEAVY FUEL OIL GIVE BETTER ECONOMY AND ENVIRONMENTAL PROTECTION.

(Rationellare eldningsoljestandard ger battre
ekonomi och miljovard). Text in Swedish. VVS (J.
Assoc. Heating, Ventilation, Sanit. Engrs.)
(Stockholm), 60 (12):643-646, Dec. 1969.
Alf H. Grennard.
Identifiers: *Fuel oils, *Fuel standards, Sweden, Ashes, Particulates, Potassium compounds, Sodium compounds, Vanadium compounds, Oxides, Sulfur compounds, Density.

To be able to reduce the emission of particulate matter from oil burning, better standards for oil products are needed. A proposal to reduce the different fuel oil classes into only two classes is suggested. The two classes would be one in the light category and one in the heavy. The quality of the oil in both categories is described in terms of density, sulfur content, carbon residue, ash content, flash point, and other properties. Sulfur content for the light oil would be 0.5% while for the heavy oil it would be 2.5%, except for naturally low sulfur oil, which would have a maximum of 1.0%.
APTIC-23439

### MAXIMUM ALLOWABLE CONCENTRATIONS, OTHER SANITARY CODES.

Transl. Communist China, no. 88:13-24, Jan. 30,
1970. (Also: Laboratory Procedures for Health
and Epidemic Prevention. (Wei-sheng Fang-i
Chien-yen). Shanghai, China, Shanghai Scientific
and Technical Publishers, 1964, Appendix VI, p.
1045-1057. CFSTI: JPRS 49725
Personal Author Not Recorded.
Identifiers: *China, *Maximum allowable concentration, Asia, Dusts, Sewage, Gases, Vapors.

Tables are presented of the maximum allowable concentrations established by Communist China for harmful gases, vapors, and dusts in shop environments; for harmful substances in the atmosphere of dwellings; for sewage draining into surface waters; and for harmful substances in surface waters. The restrictions became effective April 1, 1963.
APTIC-23578

### NEW DUST STANDARDS FOR BRITISH COAL MINES.

Nature (London), 227 (5257:445-447, Aug. 1, 1970.
12 refs.
M. Jacobsen, S. Rae, W. H. Walton, and J. M.
Rogan.
Identifiers: *Air quality standards, *Pneumoconiosis, *Dusts, *Mining, Adults, Males, Occupational health, Radiography, Quartz, Great britain, Coal, Statistical analyses.

Surveys involving dust measurements and chest radiographs were carried out over a 10-year period at 25 British collieries. The response of the miners to dusts of varying quality and composition was measured as the amount of radiological change apparent in the radiographs, which were evaluated according to the National Coal Board's new classifications for pneumoconiosis. Next, data on 4122 men employed at the coalface of each colliery for the 10 yrs of the survey were analyzed for correlations between radiological progression and dust hazards. Multiple correlation coefficients were obtained between three pneumoconiosis classifications and the mean concentration of dust, the mean mass of quartz in the dust, and the mean percentage of quartz in the dust. Probability estimates were also derived for radiological progression and translated into dust standards for coal miners. The standards, which have been accepted by the Ministry of Technology, are 4.3 mg/cu m for coalfaces and 3 mg/cu m for work in stone. The standards are expected to effect a marked reduction in pneumoconiosis in the coal mining population.
APTIC-23587

### AIR POLLUTION AND CONSTRUCTION EQUIPMENT.

Preprint, Society of Automotive Engineers, Inc.,
New York, 6p., 1970. 5 refs. (Presented at the
Society of Automotive Engineers Earthmoving
Industry Conference, Peoria, Ill., April 14-15,
1970, Paper 700551.)
R. D. Henderson.
Identifiers: *Emission standards, *Diesel engines, *Commercial equipment, Enforcement procedures, City governments, County governments, Federal governments, State governments, Regulations, California, Colorado, St louis, New mexico, New york city, Utah, Engine exhausts, Smokes, Vehicles, Ringelmann chart, Smokemeters, Hydrocarbons, Carbon monoxide, Nitrogen oxides.

The exhaust emissions produced by the diesels which power construction machinery and the standards of smoke permitted in existing or rapidly approaching regulations are discussed. Diesel particulate emissions are high, in the form of visible smoke exhaust, while hydrocarbon emissions are lower, carbon monoxide much lower, and nitrogen oxides similar when compared to uncontrolled gasoline engines. Currently, diesel smoke is regulated as a nuisance rather than as an air pollutant; smoke standards are expressed in terms of Ringelmann number or opacity, measured by the Public Health Service smokemeter. Enforcement of the 1970 Federal Diesel Smoke Standard is achieved by certification requirements on builders of diesels powering heavy duty (on-highway) motor vehicles. Smoke standards in force in California, Utah, New Mexico, New York, St. Louis, and Denver are reviewed. Construction machinery smoke is regulated in some places at the same level as on-highway equipment and there is little doubt that control will be more widespread and strict in the future. It is expected that the elimination of visible particulates will have to be accomplished while making a substantial reduction in nitrogen oxides and still maintaining machine productivity.
APTIC-23727

### SUBSTANTIATION OF THE MAXIMAL PERMISSIBLE CONCENTRATIONS OF AMMONIUM DIURANATE IN THE AIR OF INDUSTRIAL PREMISES.

(K obosnavaniyu predelyno dopustimykh
kontsentratsiy diuranata ammoniya v vozdukhe
proizvodstuennykh pomeshcheniy). Text in
Russian. Gigiena i Sanit., vol. 5:26-32, 1970. 4 refs.
G. P. Galibin, and P. A. Vlasov.
Identifiers: *Ammonium diuranate, *Maximum allowable concentration, Chronic, Rats, Occupational health, Bones, Liver, Kidneys, Lungs, Breathing, Thresholds, Toxicity, Toxic tolerances, Ussr, Buildings, Industrial areas, Reactors (nuclear), Absorption, Ammonium compounds, Uranium compounds.

In a chronic test carried out on rats, inhalation of ammonium diuranate at a concentration of 8 mg/cu m for four hours daily for a period of four months proved to be definitely toxic. The concentration of this compound in the amount of 1 mg/cu m approached the minimum effective level obtained in the chronic inhalation test. Data of clinical biochemical and pathalogoanatomical investigations are presented, and the amount of the substance absorbed by such tissues as the skeleton, the liver, the lungs, and the kidneys is given. On the basis of the experimental data obtained, the maximum permissible concentration of ammonium diuranate in the air of industrial premises is recommended to be set at a level of 0.1 mg/cu m of uranium. (Author abstract modified)
APTIC-23900

### THE ROLE OF THE SANITARY ENGINEER IN AIR POLLUTION MEASUREMENT AND ABATEMENT.

World Health Organization, Copenhagen
(Denmark), Regional Office for Europe, Proc.
Conf. Public Health Aspects Air Pollution Europe,
Milan, Italy, 1957, p. 173-193. 2 refs. (Nov. 6-14.)
Franco Cambi.
Identifiers: *Maximum allowable concentration, Engineers, Sanitarians, Mineral products, Italy, Combustion gases, Dusts, Smokes, Dispersion, Fog, Micrometeorology, Gases, Liquids, Solids, Radioactive radiation, Gamma radiation, X-rays.

Maximum acceptable concentrations are presented for gases and vapors; dusts, smokes, and fogs; mineral dusts; and gamma radiation and X-rays. The substances listed are those found most often in industrial areas as the result of combustion or technical operations; the concentrations reported are those 'defined as toxic.' Specific atmospheric conditions which favor chemical reactions between polluting agents and thus modify their composition are reviewed, as are meteorological and climatic conditions influencing the accumulation or dispersion of pollutants. Finally, it is suggested that the international standardization of air pollution terminology, units of measurement, sampling methods and instruments, and analytical methods and instruments would facilitate effects of sanitary engineers to control gaseous, liquid, and solid wastes.
APTIC-24028

### AIR POLLUTION ABATEMENT. A REPORT TO LOCAL GOVERNMENT OFFICIALS ON THE ESTABLISHMENT OF AIR QUALITY CONTROL STANDARDS FOR THE NEW JERSEY-NEW YORK-CONNECTICUT INTERSTATE AIR QUALITY CONTROL REGION.

Metropolitan Regional Council, Inc., New York,
42p., Dec. 1969. 11 refs. CFSTI: PB 191389
Alan Neustadter.
Identifiers: *Proposals, *Air quality standards, *Connecticut, *New jersey, *New york state, Abatement, Air quality criteria, Federal governments, State governments, Hearings, Legislation, Planning and zoning, Suspended particulates, Sulfur dioxide.

On Nov. 20, 1968, the Department of Health, Education, and Welfare proposed the establishment of a New Jersey-New York-Connecticut Interstate Air Quality Control Region which would encompass portions of those three states. On Feb. 11, 1969, the National Air Pollution Control Administration released air quality criteria and control technology documents for sulfur dioxide and suspended particulates. Shortly thereafter, each of the three states prepared proposed ambient air quality standards for these pollutants. During the next six months, hearings were held on the proposed standards in each of the three States as

required by the Air Quality Act. Although all three States gave primary attention to the adverse effects of pollutants on human health and lesser attention to economic, environmental, and aesthetic factors, each State devised different ambient air quality standards. New York proposed a multilevel classification system which zoned different portions of the State and the control region according to a progressive range of standards. Both Connecticut and New Jersey proposed unilevel, statewide air quality standards. New York standards were the least rigorous proposed. A point-by-point comparison of the three proposals is made, and the public hearings held in all three States are reviewed. The report is, in general, critical of all aspects of the Connecticut and New Jersey proposals that differ from the New York proposal and 'raises questions as to the degrees of compatability and synthesis that can be achieved in light of the present uncoordinated pollution proposals.'
APTIC-24046

### SUGGESTED AIR QUALITY GOALS SHORT TERM AND LONG TERM.

In: The Air Pollution Threat. Sacramento Regional Area Planning Commission, Calif., Technical Paper -6, 4p., Oct. 1969. CFSTI: PB 191382
W. L. Faith.
Identifiers: *Air quality standards, *Sacramento, Local governments, State governments, California, Oxidants, Particulates, Carbon monoxide, Nitric oxide (no), Nitrogen dioxide (no2), Sulfur dioxide, Hydrogen sulfide.

Short run goals must concentrate on gradual reduction of emissions; the greatest problem in setting long term goals (air quality standards) is to avoid disrupting the economy to a greater extent than is tolerable. The most suitable short run goal for the Sacramento area is gradual improvement of air quality, especially with respect to particulate matter. Control of automobile emissions has been pre-empted by the State and Federal governments. The long term goals of the area will be related to, and at least as restrictive as, the standards to be set forth by the California Air Resources Board. The most common range of air quality health standards proposed or set by various agencies are as follows: oxidants, 0.1 to 0.15 ppm for one hour; carbon monoxide, 5 to 30 ppm for eight hours; nitrogen dioxide, 0.1 to 3.0 ppm for one hour; nitric oxide, 0.1 ppm/hr and up; sulfur dioxide, 0.25 to 1.0 ppm for one hour; hydrogen sulfide, 0.03 to 0.10 ppm for one hour; and particulates, 100 micrograms/cu m for 24 hours and up.
APTIC-24068

### UPDATE PROPOSED FOR DIESEL FUEL SPECS.

Automotive Eng., 78 (11): 34-40, Nov. 1970.
Personal Author Not Recorded.
Identifiers: *Fuel criteria, *Diesel engines, Smokes, Fuels, Trains, Trucks, Commercial equipment, Fuel additives, Mapping.

Modifications to diesel fuel specifications have been proposed to bring the properties of the fuel more in line with the needs of the trucking industry, the railroads, and the farm, tractor, and industrial machinery operators. The present diesel fuel specifications and the revised ones proposed by Gilbert K. Brower of International Harvester are presented tabularly. Gravity distribution characteristics are discussed, as well as the maximum cloud point or freezing point. It is also proposed that a 675 F maximum end point requirement be added to D 975 and the present 90% point maximum be reduced from 640 F to 625 F. The minimum cetane number should be raised to 45, while the copper strip corrosion test temperature should be 212 F, and a maximum carbon residue of 0.15% should be specified. Storage stability, thermal (high temperature) stability, and the low-temperature fluidity test are discussed. An analysis of fuel properties, using an up-to-date version of the fuel property map first described by Blackwood and Cloud in 1940, has been made by J. A. Bert and G. H. Amberg, Chevron Research Company. This map shows how fuel properties are interrelated. An investigation of smoke suppressant additives shows that, although they reduce the level of smoke emitted, undesirable effects occur in some cases.
APTIC-24070

### DUST STANDARDS INSTRUMENTATION AND MEASUREMENT REQUIREMENTS.

Mining Congr. J., 56 (10):33-38, Oct. 1970.
Thomas E. Kobrick.
Identifiers: *Air quality standards, *Dusts, *Mining, Federal governments, Legislation, Coal, Electrostatic counters, Konimeters, Photometric methods, Samplers, Impingers.

Formation of the mandatory respirable dust standard of the Federal Coal Mine Health and Safety Act of 1969 is reviewed, as well as the requirements for sampling and instrumentation necessary to determine compliance with it. While the 2.0 mg/cu m standard is in effect, a noncompliance permit may be filled, and if approved, allow concentrations up to 3.0 mg/cu m. The 3.0 mg/cu m standard is reported to have been based on the best available epidemiologic evidence and is based to a great extent on the results of studies which have been conducted in Great Britain. Standards were established in Great Britain in 1949 based on a thermal precipitator sampler, the results of which are measured on a particle count basis. Derivation of the new 8.0 mg/cu m standard has as its goal an overall average dust concentration of 4.3 mg/cu m as the average concentration of all 'face' personnel averaged together. However, there is a wide variation between having as a goal an average concentration of a working section as opposed to an individual exposure for each man. The standard as applied in Great Britain is that of a goal to attain, and is not associated with fines, violations, or potential closure orders. Historically, the measurement of dust exposures of coal and other silica bearing dusts has been made by the use of a midget impinger, but there are other counting devices currently being used, such as the thermal precipitator and konimeter. Photometric devices which provide measurement obtained by the light scattering effects of a dust cloud have also been suggested. Variability of the sampling equipment, related studies and pump reliability are mentioned.
APTIC-24072

### CHARACTERIZATION AND CONTROL OF GASEOUS AND PARTICULATE EXHAUST EMISSIONS FROM VEHICLES.

For primary bibliographic entry see Field 03.
APTIC-24107

### A TOTAL EXHAUST EMISSION CONTROL SYSTEM.

For primary bibliographic entry see Field 02.
APTIC-24112

### TOXIC PROPERTIES OF HERBICIDE JALAN ENTERING THE ORGANISM BY THE RESPIRATORY ROUTE.

(Toksicheskiye sboystva gerbitsida yalana pri ingalyatsionnom postuplenii v organizm). Text in Russian. Gigiena i Sanit., 35 (8):35-38, 1970. 9 refs.
T. V. Dyadicheva.
Identifiers: *Maximum allowable concentration, *Toxicity, Cats, Rats, Occupational health, Respiratory system, Thresholds, Ussr, Herbicides.

Studies were made to determine the toxicity of the herbicide yalan when introduced into the body through respiratory organs. On the basis of toxic and threshold concentrations determined for cats and rats, 0.5 mg/cu m Yalan is suggested as the maximum permissible concentration in working environments.
APTIC-24171

## 12. LEGAL AND ADMINISTRATIVE

### WET SCRUBBERS FOR CUPOLA FURNACES.

For primary bibliographic entry see Field 02.
APTIC-18285

### THE PREVENTION OF POLLUTION DUE TO INDUSTRY.

(La prevention de la pollution due a l'industrie). Text in French. Genie Chim., 99 (3):357-362, Feb. 1968.
J.-P. Detrie.
Identifiers: *Abatement, *Regulations, Air quality standards, Maximum allowable concentration, France, Sulfur dioxide.

Specific rules established in order to control pollution are based either upon environmental concentration or on the concentration in the emission stage. Regulations based on environmental concentration have been sanctioned in Germany, the United States, and France. Here industry can choose from possible methods to stay below the threshold value for sulfur dioxide averaging 1 mg/cu m in the environment for a twenty-four-hour period. Difficulties in determining respective threshold values, however, hinder the successful application of this method.
APTIC-22241

### TWELFTH INTERNATIONAL CONGRESS OF SANITARY ENGINEERS, CARACAS, VENEZUELA, AUGUST 23-29, 1970. CENTRAL THEME.

(XII Congreso interamericano ingenieria sanitaria, Caracas, Venezuela, 23 al 29 del agosto, 1970. Tema Central). 9p., 1970 (°). Translated from Spanish. Belov and Associates, Denver, Colo., 8p., Jan. 29, 1970.
Personal Author Not Recorded.
Identifiers: *Meetings, *Sanitarians, Abatement, Legal aspects.

The main theme of the 12th Interamerican Congress of Sanitary Engineers is Urban Sanitation under which such topics as dwellings, consumption and its control, pollution and pollutants, and legislation and sanitary standards are discussed. Under dwelling, the analysis of the problem of housing condition with respect to sanitation is important. In the field of consumption and control, sanitation and regulation of water services and need for production of healthy food fit for human consumption are stressed. With regard to pollution, some problems of water and air pollution as well as the need for effective control are cited. The need for realistic standards for pollution based on investigations and past experiences is strongly emphasized, and more adequate legislations to cover existing deficiencies in the legal system, especially in urban sanitation and its present and future problems, are desired.
APTIC-22390

### THE ROLE OF AN EVALUATION BOARD IN A DEVICE TESTING PROGRAM.

Preprint, California State Dept. of Public Health, Los Angeles, 8p., 1960. (Presented at the Conference on Methods in Air Pollution Studies, 4th, Los Angeles, Calif., Dec. 5-6, 1960.)
R. D. MacPhee.
Identifiers: *Control agencies, *County governments, *Los angeles, Research programs, Public affairs, Control equipment, Automotive emission control, Weather modification.

The makeup, function, and experience of the Los Angeles Air Pollution Control District's Evaluation Board, allied with its automotive testing laboratory, are described. The Board was established in 1955. Its personnel are the District's Head Automotive Combustion Engineer, Assistant Director of Research, two Principle Engineers, and Head Research Assistant. The suggestions from the public, usually in the form of in-

ventions, are screened carefully by the board, correspondence carried on ideas considered to have merit are referred to the laboratory for testing and further development in conjunction with the inventor, where warranted. Typical suggestions and devices evaluated are listed for automobile controls and weather modification. The procedure is judged an efficient method for handling a sizeable and important task.
APTIC-22452

### A NEW AIR POLLUTION LAW.

Staub (English translation from German of: Staub, Reinhaltung Luft), 29 (9):8-10, Sept. 1969. 7 refs.
Wilhelm Ordinanz.
Identifiers: *Abatement, *Legislation, *Michigan, *Stack gases, Permits, Emission standards, Asphalt, Cements, Steel, Asia, Dusts, Cupolas, Incineration, Lime, Mineral processing, Primary metallurgical processing, Ringelmann chart.

The Air Pollution Law of Michigan (1967) stipulates licensing for the erection, mounting, or alteration of combustion equipment or other working processes liable to emit pollutants. An application must be submitted with the following information: quantity and temperature of the waste gas or air; the composition of waste gases with or without scrubbing; prospective content of solids in the waste gases; point of emission; height and location relative to adjacent buildings; other factors liable to facilitate the diffusion or emission in the surroundings; and information on special effects of the pollutants. The gray value of smoke plumes from furnaces must be brighter than No. 2 on the Ringelmann scale, but gray value No. 2 must not prevail for more than 3 minutes every half-hour and gray value No. 3 for no longer than 3 minutes in an hour, though not more than three time in 24 hours. Permissible limits of dust emission are presented tabularly for combustion plants, garbage incinerators, steel production, cupola furnaces for cast iron, lime kilns, asphalt preparation, cement production, and pelletizing of iron ore. Several prohibitions are also listed.
APTIC-22466

### USGS/NASA SOUTHERN CALIFORNIA REMOTE SENSING PROGRAM.

22p., May 1968. CFSTI: N 70-14082
Personal Author Not Recorded.
Identifiers: *Plans and programs, *Remote sensing, *California, Soils, Aircraft, Field tests, Research methodologies, Meteorology, Micrometeorology, Topographic interactions, Solar radiation.

A program of remote sensing missions, field data collection, and data interpretation for visiting Latin American scientists, May 20-29, 1968, at the NASA Southern California test site is described. Objectives are to study the usefulness of remote sensing techniques to produce geographic information on urban studies, soil moisture, land use, and surface energy exchange. The great physical and cultural diversity of southern California and its excellent flying weather make it a suitable test area. Aircraft, sensors, and flight lines are given, as well as protocol for ground data collection on micrometeorology, soil characteristics, solar flux, and target reflectance. Post flight ground inspection is also planned. A 'Sequence of Events' is provided in the front-matter and an appendix delineates the specific responsibilities of each participant in the anticipated program.
APTIC-22498

### PRIVATE LAWSUITS AND AIR POLLUTION CONTROL.

Amer. Bar Assoc. J., vol. 56:465-469, May 1970. 22 refs.
Leonard A. Miller, and Doyle J. Borchers.
Identifiers: *Abatement, *Litigation, *Public affairs, Governments, Legal aspects.

In view of the potential strength of private action, it is suggested that this common law remedy can serve as an alternative to the governmental programs of pollution control that have been developed. The private lawsuit may serve to bring to the forefront issues that should be solved by legislation; on the other hand, federal, state and local programs may facilitate and channel the growth of a body of common law dealing with air pollution control. Since every case has its unique aspects and every court and jury a different attitude, this lack of predictability makes the private action a poor alternative to governmental regulations. Difficulties in proving actual cause in regional air pollution, the difficulty of investigation and the nature of control needed to meet pollution problems in major metropolitan areas, often interstate areas, indicate that private action is not well suited to the solution of area-wide air pollution problems. Nuisance, negligence, and trespass are the most common actions, although many other theories have been proposed, including a strict liability theory based on products liability, statuary liability under workmen's compensation, and compensation for a 'taking' of land under condemnation proceedings. The criteria documents issued by NAPCA and the references contained in the documents should provide some assistance in determining whether damage was caused by air pollution and, if so, the identity and quantity of the pollutant required to cause the damage. In the balancing process, the social utility of an act must be weighed against the social harm, not merely the individual harm shown in the lawsuit.
APTIC-22556

### THE IMPLICATIONS OF LEAD REMOVAL FROM AUTOMOTIVE FUEL. (INTERIM REPORT).

35p., June 1970. 1 ref.
Personal Author Not Recorded.
Identifiers: *Lead compounds, *Proposals, *Automotive emission control, *Fuel additives, Costs, Federal governments, Legal aspects, Legislation, Public information, Fuel standards, Taxation, Automotive emissions, Rotary piston engines, Maintenance, Hydrocarbons, Carbon monoxide.

The effects of lead-containing fuel additives on emissions from gasoline-piston engines are presented. Addition of lead alkyls is the least expensive way to increase the octane rating of motor fuel, enabling more powerful and efficient engines to be built, but these additives interfere with the development of exhaust treatment systems, tending to inactivate catalysts. The Panel recommends that legislation should be enacted to establish the authority of the Federal government to regulate fuel additives, and that Federal tax or subsidy policies concerning automotive fuels should be modified to provide price incentive for the purchase of unleaded and low-leaded fuels. Also, changes . future fuel requirements should be reported by the automobile manufacturers to the regulatory agency at least two years in advance of production, and such information should be made public. The regulatory agency should encourage States to include an auto emission check as part of the State vehicle inspection programs. Catalytic reactors are incompatible with present high levels of lead in gasoline, while lead salts and scavengers tend to corrode the materials in thermal exhaust reactors and plug some recirculation systems proposed for nitrogen oxide control. The net lead effect on increased hydrocarbon emissions is about 20% in rapid mileage accumulations and 7% in typical customer driving. Removal or reduction in lead from gasoline could degrade valves in some present cars, probably result in an increase in the aromatic hydrocarbons, and require that other changes be made in fuel composition to maintain octane levels. Emissions can also be reduced through better maintenance of cars presently on the road. In a recent demonstration, careful tuning of the engines in 43 cars resulted in a reduction of hydrocarbon and carbon monoxide emissions of over 50% at idle. Thermal exhaust gas reactors, recirculation systems, and catalytic devices are discussed. Costs of lead reduction are included, as well as the status of petroleum refineries.
APTIC-22583

### GUIDE TO RESEARCH IN AIR POLLUTION PROJECTS ACTIVE IN CALENDAR YEAR 1969.

NAPCA Contract CPA 22-69-37, PHS Pub. 981, NAPCA Publ. AP-47, 7th ed., 193p., April 1970. 968 refs. CFSTI: PB 192220
Personal Author Not Recorded.
Identifiers: *Research programs, Survey methods, Questionnaires, Research institutes, Epidemiology, Toxicity, Sources, Monitoring, Sampling methods, Control equipment, Control methods, Instrumentation, Meteorology.

The guide to research in air pollution projects active in 1969 is divided into three parts. (1) A project list is given in which each domestic project is listed by state and each foreign project by country. An entry comprises a number assigned to the project, location and name of the research organization performing the work, project title, name and address of investigator, sponsor, and type of support. (2) Projects are listed by one of 19 subject categories with project number. (3) The name of the principal investigator is given where available, along with project number and titles of publications and presentations resulting from the project. Information for the guide was collected by questionnaire. (Author introduction modified)
APTIC-22758

### MANPOWER AND TRAINING NEEDS FOR AIR POLLUTION CONTROL.

Report to the President and the Congress in Compliance with Section 305 (b) Public Law 90-148 The Clean Air Act, as Amended, 97p., June 1970.
Personal Author Not Recorded.
Identifiers: *Control agencies, *Personnel, Abatement, Education, Federal governments, Local governments, State governments.

The 1967 amendments to the Clean Air Act created the potential for a major expansion in air pollution control activities on a nationwide basis. Further amendments proposed in 1970 will accelerate the expansion. An increased need for state and local agency employment from 2300 in 1969 to 8000 in 1974 is projected. An increase in positions in the National Air Pollution Control Administration from 1000 to 2900 is likewise projected. The amount of effort required by the private sector is forecast to increase from 20,000 to 40,000 man-years to meet the compliance requirements of state and local laws and regulations. The need exists to train 400,000 combustion equipment operators and 600,000 automobile mechanics. Recruitment is the main obstacle to staffing state and local agency programs. With the exception of specialized air pollution control technicians, private industry is expected to meet its air pollution control manpower requirements through normal recruitment procedures. Federal agency requirements will also be met through accepted recruitment efforts. A variety of programs is underway to provide solutions to the problem of state and local agency personnel requirement, career development, and retention. These programs include Federal recruitment and detail of personnel to state and local agency employees, centralized job registers, and improvements in state and local agency salaries and merit system classifications. A substantial increase in National Air Pollution Control Administration programs for technician training and short term training by the Institute for Air Pollution Training is required. Technical-level training programs would meet state and local agency needs and also provide the appropriate structure for meeting specialized technician needs in the private sector. Other Federal training programs, such as those authorized by the Manpower Development and Training Act, are available to train combustion equipment operators and auto mechanics in procedures to minimize air pollution. (Author summary modified)

APTIC-22874

### AUTOMOTIVE POLLUTION CONTROL.

In: Mass Transit and The Highway Trust Fund. Harvard School of Law, Cambridge, Mass. and Harvard Graduate School of Arts and Science, Cambridge, Mass., Dept. of Housing and Urban Development Grant H-1043, Rept. MASS-R6-11-69, p. 39-43, Jan. 1970 CFSTI: PB 19051
Donald N. Dewees, and J. Michael Hines.
Identifiers: *Automotive emission control, *Proposals, *Taxation, *Highway trust fund (htf), Federal governments, Gasolines, Automobiles, Atutomotive emission control.

A proposal is made that federal efforts to reduce automobile air pollution, including the present automotive pollution control activities of the National Center for Air Pollution Control, be financed by the Highway Trust Fund (HTF). Inclusion of pollution control in the HTF will further the goal of everyone's paying his fair share. If the program is expanded as the need for pollution control rises, then the burden on motorists who cause pollution will be in proportion to the amount of their activity. Payment of a gas tax is seen as a first step toward actually charging the motorist for the cost his pollution imposes on others. The revenues obtained from user taxes will permit more productive activities than could be produced under other methods of funding. Moreover, federal funding is justified by federal interest in establishing and enforcing national vehicular pollution standards.
APTIC-23390

### THE EFFECTS OF AIR POLLUTANTS ON HEALTH. PHASE I. EVALUATION OF RESEARCH METHODS TO BE USED IN THE STUDY OF THE EFFECTS OF LONG -TERM, LOW-LEVEL EXPOSURES IN ANIMALS AND STUDIES OF PULMONARY FUNCTIONS IN EXPOSED ANIMALS AND MAN. (FINAL REPORT).

California Univ., Los Angeles, School of Public Health, California Dept. of Public Health Contract 197, 80p., Jan. 31, 1961. 53 refs.
J. S. Felton, and C. J. Rozas.
Identifiers: *Proposals, *Research programs, *Research institutes, *Toxicity, Budgets, Plans and programs, Costs, Personnel, Personnel qualifications, Animals, Smog, Research methodologies, Testing facilities.

A program plan is presented for the creation on the campus of the California Univ. School of Public Health of an air pollution research facility. Its purpose would be to conduct controlled inhalation toxicologic investigations to determine the effects of continuous, low-level exposure to atmospheric pollutants on biologic systems. It is proposed that smog be the test pollutant and, to that end, complete analyses of the atmosphere and of naturally occurring smog are proposed, both analyses to establish the reaction kinetics as well as the composition and concentration. Exposure periods would be effectively continuous with the pollutant level being varied in accordance with the seasonal and diurnal data collected during 1956-1958 in Los Angeles. Selection of experimental species and indices of response are discussed. It is emphasized that each chosen species should include representatives of different age groups in order to more nearly represent the human population wherein the aged and infirm succumb most readily to the results of air pollution. Operation of the vivarium is detailed with respect to procedures and facilties. Administrative and operational personnel requirements are established and individual salary levels estimated, from Project Director to Janitor. Physical facility and space requirements are presented by function, and building costs for both permanent and temporary construction are estimated. An operating budget is prepared; recommendations are made as to the content of the project library; and detailed equipment lists are costed out for the animal colony, shops, labs, and offices. An appendix details information obtained during visits to existing research facilities and in consultation with investigators in the field of air pollution.

APTIC-23410

### AIR POLLUTION.

In: Environmental Quality, the First Annual Report of the Council on Environmental Quality together with the President's Message to Congress. 91st Congress, Second Session, p. 61-91, Aug. 1970.
Personal Author Not Recorded.
Identifiers: *Abatement, *Governments, *Legal aspects, Air quality measurement programs, Proposals, Research programs, Costs, Air quality criteria, Economic losses, Federal governments, State governments, Legislation, Clean air act, Regulations, Air quality standards, Plant damage, Materials deterioration, Pollutants, Industrial emission sources, Transportation, Visibility, Measurement methods, Control methods, Automotive emission control, Micrometeorology.

A review of the history and current status of both air pollution and air pollution control is presented. Pollutants and their sources are identified and discussed. The effects of air pollution on health, vegetation, materials, visibility, and climate are listed. The cost of air pollution in terms of damage and the price of control programs is included. The history of air pollution control legislation is presented, and Federal abatement actions are documented. Federal abatement actions are divided into two basic areas: mobile sources and stationary industrial sources. Except for the areas of research, advice, and support, the enforcement of controls on stationary sources is delegated to the States. Those areas remaining within the purview of the Federal Government include the establishhent and issuance of air quality standards and the development of control and measurement techniques. Air quality measurement continues on a national as well as state and local basis. Control of automotive emissions is retained by the Federal Government except to the extent the state and local agencies regulate in excess of the national regulation. Recommendations for congressional legislative action in the area of air pollution control are included.
APTIC-23421

### THE NEW WAY OF LIFE: THE FOUNDRYMAN AND CLEAN AIR.

American Coke and Coal Chemicals Inst., Washington, D. C., 10p., 1970 (*).
Personal Author Not Recorded.
Identifiers: *Codes, *Metal fabricating and finishing, *Control equipment, Local governments, Air quality standards, Emission standards, Dusts, Fumes, Smokes, Cupolas, Electric furnaces, Ringelmann chart, Particle size, Bag filters.

Air pollution codes mean that the foundryman will have to control nuisance dusts, including submicron particles, from arc melting, induction melting, and cupola melting. For arc melting, he must install the most efficient control equipment because arc-melting dusts measure five micron or less in size. For induction melting, he will have to contend with smoke and fumes, both inside and outside. Their control will require greater care in selecting and charging metallics, added space, and probably additional technical personnel. For cupola melting, he might consider a water-cooling tower with a bag house. Voluntary cooperation between the foundry and local authorities may work to the former's advantage, resulting in a code that is fair, easily enforceable, considerate of intermittent operations, and which recognizes that costs rise almost in geometric proportion to increases in dust collection efficiency. The concepts on which air pollution codes are based are air quality and source emission. The former is the amount of dust which remains in the air and contributes to general pollution. Source emission codes are designed to control dust emission at its source and use two measurement methods: process weight and dust loading. A method is presented for obtaining a rough comparison of process weight to dust loading. In addition, key features of several air pollution codes are summarized in tabular form.

APTIC-23489

### REPORT FOR CONSULTATION ON THE EL PASO-LAS CRUCES-ALAMOGORDO INTERSTATE AIR QUALITY CONTROL REGION (TEXAS-NEW MEXICO).

41p., July 1970. 11 refs.
Personal Author Not Recorded.
Identifiers: *Air quality control regions, *New mexico, *Texas, Area surveys, Air resource management, Regional governments, Planning and zoning, Socio-economic factors, Airports, Urban areas, Mountains, Particulates, Electric power production, Incineration, Dumps, Transportation, Emission inventories, Diffusion models, Point sources, Wind rose, Micrometeorology, Topographic interactions, Carbon monoxide, Sulfur oxides.

The Federal proposal for a four-county interstate region in the El Paso-Las Cruces-Alamogordo area reflects the consideration that most sources of air pollution and most people and property affected by those sources would be included in this area. Determination of this air quality control region is contingent upon present as well as future conditions of urban and industrial development. Further, the region should permit efficient and effective governmental administration of the air resource. Population and distribution, area economy, and jurisdictional boundaries are evaluated. Meteorological factors are considered, and an emission inventory is included. Sulfur oxide, carbon monoxide, and suspended particulate air levels are analyzed.
APTIC-23515

### THE TREATMENT OF WASTE GASES IN CHEMICAL INDUSTRY.

For primary bibliographic entry see Field 01.
APTIC-23562

### REPORT FOR CONSULTATION ON THE METROPOLITAN ALBUQUERQUE INTRASTATE AIR QUALITY CONTROL REGION (NEW MEXICO).

33p., July 1970.
Personal Author Not Recorded.
Identifiers: *Albuquerque, *Air quality control regions, New mexico, Airports, Mountains, Valleys, Particulates, Steam plants, Domestic heating, Open burning, Dumps, Transportation, Emission inventories, Diffusion models, Point sources, Meteorology, Atmospheric movements, Inversion Topographic interactions, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Sulfur oxides, Area surveys, Air resource management, Regional governments, Planning and zoning.

The proposed Albuquerque Intrastate Air Quality Control Region was designed to include those locations where present development creates, or where projected urbanization and industrialization will create, significant air pollution problems. As is typical of mountain-valley configurations, the Rio Grande Valley serves as a north-south channel for the air circulation patterns to which it is subjected. Atmospheric conditions within this valley lead to the formation of inversions which, together with restricted pollutant dispersion potential to the east and west, are likely to intensify the level of air pollution in the area. Metropolitan Albuquerque is expected to remain the focal point of growth in central New Mexico, and will be responsible for the projected population and economic growth of Bernalillo County in its entirety. An emissions inventory of the area is included, as well as an evaluation of the population distribution, manufacturing and general economic activity, and existing air pollution control arrangements.
APTIC-23570

### TAKING POLLUTERS TO THE COURTS.

Sci. News, 98 (13):273-274, Sept 26, 1970.
Richard Gilluly.
Identifiers: *Litigation, *Citizens groups, Abatement, Control agencies.

Noting that Federal regulatory agencies are often reluctant to go to court, citizen advocates of court action are now pressing criminal charges against polluting industrial operations. They are being aided in their actions by senators who have introduced bills to permit citizens to sue the Government over environmental matters, to give 'standing' to any citizen with an environmental grievance, and to eliminate the requirement for proof of specific damage. Among organizations prominent in establishing the defacto power of citizens groups to fight in the courts for a clean environment is the Environmental Defense Fund (EDF), which argues that the Ninth Admendment to the Constitution provides a constitutional right to a decent environment. Although one suit based on this argument was turned down before reaching trial, the judge did not foreclose the possibility that citizens might make use of the Ninth Admendment and other constitutional arguments. Scientists frustrated by their inability to move regulatory agencies with their expert knowledge are now finding that they have an entity for effective action in organizations such as the EDF.
APTIC-23586

### BASIC POLICY REGARDING THE ESTABLISHMENT OF PUBLIC NUISANCE CONTROL PROGRAM FOR THE OSAKA AREA.

(Osaka chiiki ni kakawaru kogaiboshikeikaku
sakutei no kihon hoshin. An). Text in Japanese.
Yosui to Haisui (J. Water Waste), 12 (9):759-767,
Sept. 1, 1970.
Personal Author Not Recorded.

Identifiers: *Control programs, *Osaka prefecture, Abatement, Air quality measurement programs, Standards, Maximum allowable concentration, Steel, Japan, Airports, Industrial areas, Harbors, Rivers, Automotive emissions, Combustion products, Odors, Particulates, Suspended particulates, Fuel oils, Industrial emission sources, Water pollution, Automobiles, Arsenic compounds, Cyanides, Metal compounds, Cadmium compounds, Chromium compounds, Lead compounds, Mercury compounds, Organic phosphorus compounds, Organometallics, Carbon monoxide, Sulfur oxides.

A control program is presented which is to be effective throughout Osaka Prefecture which has long been developing as a large industrial area; the enormous economic activity has added much to the pollution problem. Air pollution is severe in the central and Hanshin coastal industrial district, and water pollution is significant in Yodo, Kanzaki, Neya and Yamato Rivers. Water quality in Osaka Bay has deteriorated to the extent of ruining the fishing industry. The ground settling problem in East-Osaka, and the noise from Osaka International Airport have invited many complaints. The pollution levels are to be lowered to within the tabulated limits by 1980. There are many necessary control measures, but the following are especially emphasized in view of the national planning priorities. They are the control measures against stationary air pollution sources, purification of coastal waters and rivers and streams, control of nuisances accompanying automobile traffic, treatment measures for metropolitan and industrial wastes, and the control of airport noises. In addition, surveillance and measurement systems as well as cooperation with the neighboring prefectures are indispensible. Detailed tables are given on the target maximum allowable concentrations of sulfur oxides, suspended particulates, and carbon monoxide in air as well as for cyanides, alkyl mercury, organic phosphorous, cadmium, lead, chromium, arsenic, and mercury in general for water pollution. Values for pH, BOD, SS, DO and coliform bacteria counts are also given. The maximum allowable noise levels for daytime, morning and evening are also listed.
APTIC-23608

### BASIC POLICY REGARDING THE ESTABLISHMENT OF A PUBLIC NUISANCE CONTROL PROGRAM FOR THE TOKYO AREA.

(Tokyochiiki ni kakawaru kogaiboshikeikaku
sakutei no kihonhoshin. An). Text in Japanese.
Yosui to Haisui (J. Water Waste), 12 (9):750-758,
Sept. 1, 1970.
Personal Author Not Recorded.

Identifiers: *Control programs, *Tokyo, Abatement, Air quality measurement programs, Standards, Maximum allowable concentration, Japan, Industrial areas, Harbors, Rivers, Automotive emissions, Combustion products, Odors, Particulates, Suspended particulates, Boilers, Electric power production, Primary metallurgical processing, Water pollution, Automobiles, Arsenic compounds, Cyanides, Metal compounds, Cadmium compounds, Chromium compounds, Lead compounds, Mercury compounds, Organic phosphorus compounds, Organometallics, Carbon monoxide, Sulfur dioxide.

A control program to be effective throughout the Tokyo metropolitan area other than islands in the Pacific Ocean under the jurisdiction of the metropolitan government is presented. The area is a megalopolis with 11.5 million people, and the industrial and economic activities are increasingly exacerbating the pollution problem. Air pollution from automobiles and factories is severe. It originates from the central and Joto areas as well as from factories along the Arakawa River and Sumida River. Water pollution in Sumida, Naka, and Tama Rivers is also intense. The pollution levels are to be lowered to within the tabulated limits by 1980. The necessary control measures are numerous, but the following are especially emphasized in view of the national planning priorities. They are the control measures against stationary air pollution sources, purification of sea water in the coastal areas and fresh water in rivers and streams, control of nuisances accompanying automobile traffic, control of ground settling (in some areas as deep as four meters), and treatment measures for metropolitan and industrial wastes. In addition, the establishment of nuisance monitoring and measurement system is necessary, and close cooperation with the neighboring prefectures is indispensable. Detailed tables are given on the target maximum allowable concentrations of sulfur oxides, suspended particulates, and carbon monoxide in air as well as cyanides, alkyl mercury, organic phosphorus, cadmium, lead, chromium, arsenic, mercury in general and pH, BOD, SS, DO, and coliform bacteria values for water pollution. The maximum allowable noise levels for daytime, morning and nighttime are also listed.
APTIC-23610

### POLLUTION CONTROL: A CORPORATE DILEMMA.

Instrum. Technol., 17 (7):34-36, July 1970.
(Presented at the ISA Chemical and Petroleum
Instrumentation Symposium, 11th National,
Chicago, Ill., 1970.)
William B. Halladay.

Identifiers: *Abatement, *Commercial firms, *Management personnel, Commerical firms, Federal governments, Legislation, Socioeconomic factors.

Some of the factors in fighting pollution at the corporate level include huge capital investments, inadequate technology, changing standards of air and water quality, and an aroused public demanding quick solutions. At the federal level, far too much division of responsibility and authority prevails, and the time has come for a consolidation of these related activities into an environmental 'watchdog' agency or department. Legislation without technological capabilities or adequate financing is futile. Every company should have a specialist whose job it will be to be keenly aware of existing, pending, and probably future legislation, to spark suggestions and implementation of conservation programs within various line organizations, to assist in making policy, and to keep abreast of pertinent technological advances. Only with cost awareness, however, can programs and actions be realistically scheduled within the company's capital framework and expenditure. The company should urge employees at all levels to become involved in community leadership programs and projects relating to an improved environment.
APTIC-23612

### GOVERNMENT SPONSORED AIR POLLUTION RESEARCH RELATING TO AGRICULTURE.

J. Air Pollution Control Assoc., 11 (5):248-250,
257, May 1961. 14 refs. (Presented at the Air
Pollution Control Association, 53rd Annual
Meeting, Cincinnati, Ohio, May 22-26, 1960.)
C. Stafford Brandt.

Identifiers: *Agriculture, *Research programs, *Federal governments, Abatement, Legislation, Farms, Odors, Aerosols, Dusts, Food and feed operations, Primary metallurgical processing, Crop spraying, Solid waste disposal.

Spray programs, waste disposal, cultivation practices, and handling and processing of agricultural products all give rise to many air pollution problems of dusts, aerosols, and odors. The purpose of investigations and research in this field is to yield the observations and hypotheses by which the problem may be delineated and limited, and upon which the limits of a solution may be based. No amount of research or investigation will in itself ever solve an air pollution problem. The first major air pollution problems affecting agriculture in this country arose at the turn of the century as a result of fumes from smelters. Particularly in the west, the federal government became seriously involved in these problems. With the passage of Public Law 159 of the 84th Congress in 1955, provision was made for the granting of funds to individual research workers in the field of air pollution for specific projects. Several of these projects are mentioned. The role of the federal government in the field of air pollution as it affects agriculture is twofold: it should provide technical assistance and supplementary funds in approaching the solutions or in collecting the data upon which solutions can be based; and it also should provide the leadership in the necessary general investigations of the effects of known or suspected airborne toxicants upon fundamental processes of plants and animals.
APTIC-23656

### THE BASIC LAW AGAINST AIR POLLUTION.

Sluzbeni List SFRJ, 21 (30), 3p., June 1965.
Translated from Yugoslavian. Belov and
Associates, Denver, Colo., 10p., June 15, 1970.
Personal Author Not Recorded.

Identifiers: *Abatement, *Legislation, *Yugoslavia, Administration, Control agencies, Enforcement procedures, Federal governments, Planning and zoning, Air quality standards, Equipment standards, Europe, Dusts, Smokes, Industrial emission sources, Transportation, Measurement methods, Control methods.

The air pollution law of Yugoslavia establishes community air pollution control agencies within the existing sanitary inspection agencies. These air pollution control agencies are responsible for the implementation of the law. Air pollution is defined as all kinds of release or injection into the air of gases, steam, smoke, dust, radioactive material, and any other material with a potentially adverse effect on health or property. The law is applicable to business; industry; vehicles with internal combustion engines; locomotives; ships; transportation, storage, and removal of hazardous material; air pollution control equipment; and air pollution detection and measurement instrumentation. Construction of any potential emission source is prohibited until it is demonstrated that the planning includes adequate pollution control with approved devices. Operation of such a facility is prohibited until it is demonstrated that the installed pollution control equipment performs efficiently. Urban development plans are directed to be prepared that establish sanitary zones between

plants and residential areas. Business and industry are required to maintain personnel, equipment, and instrumentation to meet the requirements of the law. Failure to maintain records of air pollution data is punishable by fine. All expenses incurred in meeting these requirements are to be the responsibility of the business or industry incurring the expense. Air quality standards, lists of approved control equipment, and lists of approved instrumentation will be issued by the Secretary for Health and Social Action (Federal Level). Existing facilities will comply with these requirements in the time decreed by the local air pollution control agency; except in extreme instances, this will be within 4 years and in no case will it exceed 7 years. In case of violation, the offending business and its principal executive officer are fined separately and heavily. It is interesting to note that the second most serious violation involves marketing an air pollution control device that does not perform efficiently.
APTIC-23663

### ALTERNATIVE GOVERNMENTAL ORGANIZATIONS TO DEAL WITH AIR POLLUTION.

In: The Air Pollution Threat. Technical Paper - 7,
4p., Oct. 1969. 4 refs. CFSTI: PB 191382
Personal Author Not Recorded.
Identifiers: *Control agencies, *Local governments, *California, Abatement, Administration, Regional governments.

The characteristics of four types of government organizations to deal with air pollution control at the local level in California are briefly described. The usefulness of existing jurisdictions (boards of supervisors and city councils) is limited because air pollution is not consistent with political boundaries, and because of the high cost of an effective control program. Single county control districts enforce relevant provisions of the California Health Code and enact enforcement regulations. Authority over agricultural operations is limited. Unified control districts exist where single county districts are permitted to merge into a single agency with funds appropriated in proporation to population. Powers are the same as for single county districts. Regional control districts are established from two or more counties, after public hearings; the district must be entirely within an air basin as defined by the State Air Resources Board. A representative from each county and incorporated city is on the governing board. Powers are the same as those of any special district excepting taxation. A control officer and hearing board are appointed. Agricultural burning can be regulated. Funds are apportioned according to real estate values and population.
APTIC-23665

### PAINT INDUSTRY SMOG CHAMBER. 3. FINAL TECHNICAL REPORT ON THE ROLE OF SOLVENTS IN PHOTOCHEMICAL-SMOG FORMATION.

For primary bibliographic entry see Field 03.
APTIC-23676

### LEGAL PROBLEMS OF PLANNING FOR ENVIRONMENTAL HEALTH IN METROPOLITAN AREAS.

Preprint, Robert A. Taft Sanitary Engineering
Center, Cincinnati, Ohio, 25p., 1962, 47 refs.
(Presented at the Conference on Urban Planning
for Environmental Health, Cincinnati, Ohio, April
5, 1962.)
Sidney Edelman.
Identifiers: *Metropolitan areas, *Local governments, Planning and zoning.

Local government in the United States is discussed, as well as its relationship to metropolitan problems, together with a description of governmental approaches which have been suggested to meet the needs of metropolitan areas. Widespread use of automobiles, continued road construction, and discontent with life in the cities have created sprawling centers of urban life in areas outside of the cities, subjecting counties and other local governments to a new demand for local services which they are not equipped to furnish. Methods which have been employed to deal with this problem include: annexation, city-county consolidation, city-county separation, federation, functional transfers and joint efforts, and metropolitan special districts. Although Baltimore, San Francisco, St. Louis, and Denver are examples of city-council separation which resulted in more efficient governments for the cities concerned, this method is not considered seriously as a proposal for dealing with metropolitan problems. While separation offers financial benefit to the city, it leaves the county with reduced resources and may not include the metropolitan area. The basic element of federation is the division of functions between a metropolitan government and the existing municipalities within its territory. Composed of 13 municipalities, the Toronto Metropolitan Federation came into being on April 15, 1953, while the plan for Dade County, Florida, also has many of the basic characteristics of a federal plan. Most metropolitan special districts are created to assume responsibilities for one particular function, such as sewage disposal, while others are multipurpose, such as the Port of New York Authority and the Orleans Levee District.
APTIC-23695

### THE POLITICS OF AIR POLLUTION: PUBLIC INTEREST AND PRESSURE GROUPS.

Arizona Law Rev., vol. 10:37-47, 1968. 9 refs.
Gladwin Hill.
Identifiers: *Abatement, *Governments, *Social attitudes, Administration, Legislation, Public affairs, Citizens groups.

Because air pollution is a collective problem of society, it must be dealt with at the governmental level, thus inevitably involving political considerations. The crux of the problem at present is public ambivalence; while everybody wants cleaner air, people are not entirely ready to make the necessary social and economic readjustments. Resistance to regulation at the local level is less likely to be labelled Republican or Democrat than Establishment; the entrenched interests may be of either party. Thus, air pollution control has advanced much further and faster in Los Angeles, where city and county governments are non-partisan by law, than in New York City. Nevertheless, there are numerous examples where the local power structure and political machine elements are strongly in favor of pollution clean-up and thus have accelerated rather than obstructed control efforts, e.g., Chicago. Broadly generalizing, industry shares the public's ambivalence about air pollution reform, engaging in extensive research on one hand, yet resisting control legislation on the other. The fluidity of smog politics works two ways. It makes the progress of nation-wide remedial measures erratic and not necessarily logical, but it also makes the problem extraordinarily sensitive to citizen pressures. To fill the vacuum created by the states' tardiness in controlling pollution, the federal government entered the field through the back-door of health (via the Dept. of Health, Education, and Welfare), although in the public's current viewpoint, the health implications of smog are secondary to esthetic and economic considerations. Finally, the politcal finesse of air pollution officials in dealing with local governmental bodies is often critical in the success or failure of an abatement program.
APTIC-23724

### THE BISHOP CASE - AN INTERSTATE ODOR PROBLEM.

Preprint, National Air Pollution Control
Administration, Durham, N. C., Div. of
Abatement, 11p., 1970. 2 refs. (Presented at
Rutgers University, New Brunswick, N. J., May
13, 1970.)
Robert T. Walsh.
Identifiers: *Litigation, *Odors, *Rendering, Commercial firms, Enforcement procedures, Federal governments, State governments, Hearings, Clean air act, Complaints, Delaware, Maryland.

The rendering plant of the Bishop Processing Co. in 1965 became the focal point of the first interstate abatement conference initiated under the Clean Air Act. The plant, located in Maryland, was causing a severe odor pollution problem in the nearest community, Selbyville, Del. A technical investigation evaluated the odor potential of each process in the plant and the control measures in use or potentially applicable; then the abatement conference was held, with officials from Md., Del., and the Dept. of Health, Education and Welfare unanimously recommending remedial measures. Company failure to carry these out led to the first public hearing conducted under the Clean Air Act, then to a suit in the U. S. District Court in Md. which upheld the abatement provisions of the Act and their application by National Air Pollution Control Administration officials. The same court later ordered the plant shut down as required by the terms of a consent degree signed by the company in a pre-trial action. The company appealed to the Supreme Court, which, in deciding not to review the lower court's cease and desist order, upheld the decision and the Act.
APTIC-23754

### COMPREHENSIVE WATER SUPPLY, SEWERAGE, SOLID WASTE AND AIR POLLUTION CONTROL PLANS.

David B. Smith Engineers, Inc., Gainesville, Fla.,
Proj. 6914, HUD Proj. FLA. P-104, 139p., Feb.
1970. 11 refs. CFSTI: PB-191553
William R. Sabis, David H. Scott, and David B.
Smith.
Identifiers: *Control programs, *Planning and zoning, *Palm beach county, Abatement, Air resource management, Enforcement procedures, County governments, Clean air act, Socioeconomic factors, Florida, Automotive emissions, Steam plants, Food and feed operations, Incineration, Laundries, Mineral processing, Sewage, Dumps, Water pollution, Vehicles.

A long range comprehensive plan for Palm Beach County, Florida regarding air pollution control, water supply, sewerage, and solid wastes disposal is presented. A geographical description of the area, including land use and trends, population projections, and transportation networks is provided. A report of air quality measurements in the area is included. Sources in the area include incinerators, automobile exhausts, certain industrial discharges, dumps, and agricultural operations. An air pollution control plan, under the auspices of the Air Quality Act, is recommended. It includes the establishment of an air quality region and suitable enforcement and regulatory measures.
APTIC-23765

### AIR AND WATER POLLUTION--ARE WE MAKING PROGRESS"

Proc. Am. Power Conference, vol. 30:117-125,
April 1968.
Clarence W. Klassen.
Identifiers: *Abatement, *Federal governments, *State governments, *Air quality standards, *Water pollution, Research programs, Enforcement procedures, Public information.

Abatement of air and water pollution is discussed within the context of 10 selected parameters of progress: standards; legislation; Federal-state-interstate relations; research; role of the news media; state and potential polluters relations; stream water quality; ambient air quality; and enforcement procedures. Some progress has been made by states in setting water quality standards but there is yet no concrete evidence of real progress in setting air quality standards, especially in the more controversial areas such as gas emissions. Among the obstacles to air quality standards

are Federal requirements that they be realistic, obtainable, and measurable with reasonable precision and accuracy. It is regretted that newer water pollution control programs have relegated interstate agencies to a minor role and that state agencies and the Department of Health, Education and Welfare show little evidence of cooperating on interstate air pollution problems. Federal research grants are not advancing technological solutions to pollution problems: practical breakthroughs will more likely result from research and development carried on by industry itself. Due partly to the news media and also to stricter enforcement procedures, industry is now recognizing its responsibility to control pollution. Once the needed technology is available, progress in air pollution should proceed at a rapid rate. However, at the present time, demonstrated improvements in air quality are still few. Progress in water quality is more marked.
APTIC-23799

### APPLICATIONS OF AEROSPACE TECHNOLOGY IN AIR POLLUTION CONTROL.

Contract NASW-1950, RTI Rept. EU-469,
Quarterly Progress Rept. 1, 29p., Sept. 14, 1969.
CFSTI: N70-28161
Personal Author Not Recorded.
Identifiers: *Computers, *Data-handling systems, *Advisory services, *Federal governments, Control agencies, Measurement methods, Control methods.

The Technology Utilization Division of the National Aeronautics and Space Administration is making extensive and concentrated efforts to apply the scientific and technological knowledge gained in the nation's aerospace programs in order to solve or aid in the solution of problems in the public sector. An evaluation of the activities in the specific area of air pollution is presented. The general methodology that has been employed can be subdivided into four major phases of activity: problem identification and specificiation; identification of relevant information or technology; evaluation of potentially applicable information or technology; and documentation. Of 41 problems identified, 21 were selected on the basis of priority, and computer searches were initiated to obtain relevant information. Two technology transfers have resulted from the searches. A complete list of the active problems is presented, and technology transfer and potential transfer reports are included. Some of the problems mentioned are control methods for various pollutants, measurement methods, and the effects of pollutants on humans.
APTIC-23866

### PUBLIC NUISANCE WHITE PAPER.

(Kogai hakusho). Text in Japanese. Japanese Office of the Prime Minister, Tokyo, Agency of Economic Planning, Tokyo (Japan), Agency of Science and Technology, Tokyo (Japan), Agency of Defense Installations, Tokyo (Japan), Ministry of Justice, Tokyo (Japan), Ministry of Education, Tokyo (Japan), Japanese Ministry of Health and Welfare, Tokyo, Ministry of Agriculture and Forestry, Tokyo (Japan), Ministry of International Trade and Industry (Japan), Ministry of Transportation, Tokyo (Japan), Ministry of Labor, Tokyo (Japan), Ministry of Construction, Tokyo (Japan), and Ministry of Autonomy, Tokyo (Japan), 295p., 1970.
Sadanori Tanaka, and Uchida Tsuneo.
Identifiers: *Trends, *Abatement, *Japan, Air quality measurement programs, Control agencies, Federal governments, Legislation, Emission standards, Humans, Plant damage, Respiratory functions, Automotive emissions, Stack gases, Dusts, Suspended particulates, Smog, Smokes, Natural gas, Mining, Desulfurization of fuels, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Sulfur dioxide.

The trends of public nuisance problems in Japan are presented. Because of emission standards for sulfur dioxide, areas that had very high concentrations have improved. Dust particles are on the increase. Photochemical smog problems are being recognized. No work is being done on suspended particulates or oxides of nitrogen. Detailed descriptions of pollution problems caused by sulfur oxides, carbon monoxide, nitrogen oxides, and other harmful substances are given. Areas of severe pollution are discussed. Human health problems due to air pollution are mainly respiratory in nature. Specific effects are listed for sulfur oxides, carbon monoxide, nitrogen oxides, hydrocarbons, and suspended particulates. Agricultural damages are enumerated. Measures taken to control public nuisances are listed. Standards for sulfur oxides emission are based on not exceeding 0.05 ppm. The attainment of these limits will be promoted by low-sulfur fuels and natural gas, and by desulfurization of petroleum products. Carbon monoxide emissions must be below 10 ppm for a 24 hour period. Air pollution legislative measures, including control of automotive emissions and smoke from mines, is discussed. Monitoring systems for winds and the various pollutants are discussed. The operation of a Public Nuisance Control Enterprise Organization is described.
APTIC-23892

### MOTOR VEHICLE POLLUTION CONTROL NEWS.

For primary bibliographic entry see Field 03.
APTIC-23908

### TEST CASE ON INJURY CLAIMS.

Chem. Week, vol. 77:34, 36, Dec. 3, 1955.
Personal Author Not Recorded.
Identifiers: *Fluorine compounds, *Litigation, *Metal fabricating and finishing, Abatement, Costs, Cattle, Vegetables, Plant damage, Health impairment, Aluminum, Farms, Fumes.

Reynolds Metals Company has decided to petition the U. S. Court of Appeals in San Francisco to reverse the Sept. 16 verdict in a district court at Portland, Ore., which awarded $38,293 to the Martin family. Up to 1950, the Martins were operating a 1500-acre cattle ranch on a ridge a mile or so east of the Reynolds plant. Their first successful move against Reynolds was a civil suit in which they were awarded $47,000 for damages to cattle and ranch property. In the personal injury suit, Martin contended that fluorine fumes from the plant contaminated not only the air that he and his family breathed but also the vegetables they grew and ate on the ranch. Since 1946 when Reynolds had acquired the plant on the Columbia River, it has installed $2.5 million worth of waste gas treatment equipment. Principal witnesses in the trial are listed, as well as the basis for Reynolds' appeal.
APTIC-24010

### BUDGET REQUIREMENTS FOR A SIX COUNTY REGIONAL AIR QUALITY CONTROL DISTRICT.

In: The Air Pollution Threat. Technical Paper - 9, 2p., Oct. 1969. CFSTI: PB 191382
Personal Author Not Recorded.
Identifiers: *Budgets, *Control agencies, *Sacramento, Grants, Regional governments, California.

A revised annual budget of $270,000 is presented for the six-county air quality control district proposed for the Sacramento region, to cover staff, overhead and supplies, and capital equipment. To provide the necessary revenues, it is assumed that Federal funds will continue to be available on the same terms as at present, that an 'establishment grant' would be approved for 75% of the program cost for a three-year period, and that annual 'maintenance grants' for 60% of program cost would be approved for the fourth and subsequent years. The balance would come from the six counties involved (El Dorado, Placer, Sacramento, Sutter, Yolo, and Yuba).
APTIC-24014

### THE CONTROL OF NOXIOUS GASES AND FUMES DISCHARGED FROM INDUSTRIAL UNDERTAKINGS.

For primary bibliographic entry see Field 02.
APTIC-24033

### STATEMENT OF BENJAMIN LINSKY, P. E., PROFESSOR IN AIR POLLUTION CONTROL ENGINEERING, DEPARTMENT OF CIVIL ENGINEERING, WEST VIRGINIA UNIVERSITY, MORGANTOWN, W. VA.

In: Air Pollution-1970, Part 1. 91st Congress, (Senate) Second Session on S. 3229, S. 3466, S. 3546, p. 250-343, 1970. (Hearings before the Subcommittee on Air and Water Pollution of the Committee on Public Works, March 16-18, 1970.)
Benjamin Linsky.
Identifiers: *Abatement, *Costs, *Legislation, West virginia.

Testimony is presented to show that clean air can be restored to cities, towns, and the countryside at small added costs to the national economy's production, to the regulatory Government tax budgets, and to each citizen-consumer. Reliable cost data, it is noted, have not been made available to Congress or the general public because technical editors and air pollution control officers fear they will endanger their jobs or limit their opportunities for promotion. The price of electricity is cited to illustrate the cost to the consumer of control equipment for fly ash. While each year's deferment is worth about $250,000 to $300,000 to an electric power company, the added retail cost to the consumer would be less than one percent. Just as the cost of eliminating pollution adds a very small percentage to a polluting source's construction and operating costs, the costs of enforcing tighter regulatory limits will require only a nominal tax increase. Expected annual control costs relative to capacity and shipment are presented for 17 typical industrial process sources. In addition to requiring all new plants to use the best possible control technology, it is recommended that plant sites be regulated by local or state governments. Included with the testimony is the full text of the Air Pollution Control Law of West Virginia, which the witness help to draft.
APTIC-24044

### APPENDIX.

In: Air Pollution-1970, Part 1. 91st Congress (Senate), Second Session on S. 3229, S. 3466, S. 3546, p. 345-446, 1970. 23 refs. (Hearings before the Subcommittee on Air and Water Pollution of the Committee on Public Works, March 16, 17, 18, 1970.)
Personal Author Not Recorded.
Identifiers: *Research programs, *Senate hearings, Abatement, Grants, Costs, Air quality criteria, Federal governments, Planning and zoning, Regulations, Personnel, Emission standards, Particulates, Automotive emission control, Nitrogen oxides, Sulfur oxides, Sulfur dioxide.

Answers are provided by the Department of Health, Education, and Welfare to questions supplied by the Subcommittee on Air and Water Pollution through Chairman Muskie. Priorities and time schedules are asked for air quality criteria additional to those for particulate matter, sulfur oxides, hydrocarbons, photochemical oxidants, and carbon monoxide. Question 6 requires information on the research relating to the long-term effects of contaminants, and question 7 is concerned with research relevant to the carcinogenic and mutagenic effects of contaminants. National Air Pollution Control Administration contracts under section 104 are listed for control of sulfur oxide pollution, nitrogen oxides pollution, particulate pollution, control of pollution from specific industries, from solid waste disposal, control device improvement studies, automotive emissions control, and alternatives to the internal combustion engine. Funding for motor vehicle pollution control research and development is discussed, as well as the NAPCA 6-year plan for vehicle research and the clean car incentive program. The data available

on compliance with auto emission standards after sale by certified vehicles and the estimated effect of failure to comply with automotive emission standards on projected air pollution levels are questioned. The rental car exhaust emission surveillance program is also mentioned. Assessment of penalties and the extent to which States have applied for the two-thirds grants for developing emission device inspection programs are discussed. Questions are asked as to the status of air quality control regions, the filing of letters of intent, and the establishment of standards and implementation plans. Recent trends in air pollution control regulations are analyzed as they pertain to visible emissions, particulate and sulfur oxide emissions from fuel burning equipment, process equipment, incinerators, and odors. Fuel additives and noise pollution are discussed; NAPCA personnel and staffing are cited, as well as governmental expenditures.
APTIC-24045

### A SUGGESTED PROGRAM FOR THE SACRAMENTO REGION.

In: The Air Pollution Threat. Sacramento Regional Area Planning Commission, Calif., Technical Paper -8, 5p., Oct. 1969. CFSTI: PB 191382
W. L. Faith.
Identifiers: *Administration, *Sacramento, *Air quality control region, Adminstration, Budgets, Plans and programs, Control agencies, Regional governments, Planning and zoning, Personnel, California.

The establishment of a regional district covering the same area as that included in the boundaries of the Sacramento Regional Area Planning Commission is suggested as the most appropriate form of air pollution control agency for the Sacramento area. Major functions would include development and administration of control regulations, administration of the permit system required to gain Federal financial support, measurement of emissions and air quality, maintenance of enforcement program, and various public information, government liaison, laboratory, and other support activities. An initial staff of 18 would operate the Director's office and engineering, technical, and field services. Suggested annual budget for the agency would be $266,250 with about a fourth from the counties involved; the District may be eligible to receive the balance from Federal assistance programs.
APTIC-24059

### AIR POLLUTION: OUR TASK IS TO GATHER FACTS.

Scientiae, 11 (5):27-31, May 1970.
E. C. Halliday.
Identifiers: *Research programs, *Research institutes, *South africa, Africa, Urban areas, Engine exhausts, Smog, Smokes, Diesel engines, Sulfur dioxide, Photochemical reactions.

The Air Pollution Research Group aims to provide the information upon which administrative and governmental decisions may be made concerning air pollution. During the course of the public agitation over the Los Angeles smog and the London fog, South Africa began to take an interest in air pollution. Research was undertaken to study the incidence of pollution in South African cities, the physical and chemical nature of the pollutants and the physical process which dissipates the pollutants throughout the atmosphere and finally returns them to the earth's surface. The first investigation which was undertaken was to measure the concentrations of smoke and of sulfur dioxide at a number of sites in Pretoria. Another task concerns the photochemical smog which is experienced in Pretoria, Johannesburg, and Durban. Diesel engines and traffic regulations are mentioned, and some results from the investigations are indicated.
APTIC-24069

### THE U. S. GOVERNMENT AIR POLLUTION CONTROL PROGRAM.

Preprint, Department of Health, Republic of South Africa, 66p., 1970. (Presented at the Conference on Air Pollution, Republic of South Africa, Oct. 14-15, 1970.)
John W. Ludwig.
Identifiers: *Plans and programs, *Control agencies, *United states, Federal governments, Clean air act, Personnel, Engine exhausts, Odors, Particulates, Natural gas, Gasolines, Internal combustion engines, Automobiles, Analytical methods, Measurement methods, Afterburners, Timed fuel injection, Sulfur oxides control, Mathematical modeling, Diffusion models, Air pollution forecasting, Fluorides, Carbon monoxide, Nitrogen oxides.

A description of the air pollution control program of the United States Government is presented. The Clean Air Act is the basic document outlining the approach to air pollution control in the U. S. The Air Quality Act of 1967 calls for a systematic, regional effort to combat air pollution. The operating responsibilities for the Federal air pollution program are carried out by the National Air Pollution Control Administration. In its present form, there are 11 organizational units to carry out the operations of the Administration. The Bureau of Criteria and Standards has sub-divisions of Health Effects, Economic Effects, and Air Quality and Emissions Data. The Bureau of Engineering and Physical Sciences has sub-divisions of Process Control Engineering, Chemistry and physics, and Meteorology. The Mobile Source Program involves motor vehicles as sources, and also does research and development work. The Bureau of Abatement and Control is the interface between the Federal program and State and local Agencies. An indication of funding distribution is presented to give a feel for the major program emphasis. The control programs utilize a priority system of pollutants. The order is: sulfur oxides, particulates, nitrogen oxides, carbon monoxide, fluorides, and odors. Many of the control methods now being studied are described. The measurements methods and instrumentation used by NAPCA are described. Programs initiated to forecast air pollution potential and models used in predicting air pollution concentrations are described. The thrust of NAPCA's efforts to control automobile exhausts lies in three areas: induction system alterations, such as fuel injection; alternative fuels, such as natural gas; and exhaust treatment, such as thermal reactors. The functions of the various Offices within NAPCA are described.
APTIC-24122

## 13. SOCIAL ASPECTS

### A FIELD SURVEY TO DETERMINE PUBLIC OPINION OF DIESEL ENGINE EXHAUST ODOR. (FINAL REPORT).

Southwest Research Inst., San Antonio, Tex., Vehicle Emissions Research Lab., NAPCA Contract PH 22-68-36, SwRI Rept. AR-718, 166p., Feb. 1970. 8 refs. CFSTI: PB 191529
Karl J. Springer, and Charles T. Hare.
Identifiers: *Opinion surveys, *Engine exhausts, *Odors, *Diesel engines, Area surveys, Survey methods, Questionnaires, Social attitudes, Mobile, Urban areas, Odorimetry, Calibration methods.

A workable method of sampling public opinion of diesel exhaust odor was conceived and employed. The method involved use of a calibrated mobile odor evaluation laboratory similar to the odor room used by the trained odor panel at SwRI. Opinions on a series of three levels of diesel odor were obtained from 3039 persons whose backgrounds, ages, and places of residence are well distributed with respect to the total urban population. A majority of all the participants rated more intense diesel exhaust odors higher on the cartoon-objectionability scale than less intense odors. Approximately 75% of the participants selected a higher cartoon number for test 2 ('D-4') than for test 1 ('D-2') and about 86% of them found test 3 ('D-6') more objectionable than test (1'D-2'). This determination is based on results obtained from 3039 people in five major U. S. cities. Some variation in odor response from city to city can be found which remains unexplained by consideration of variation in socioeconomic characteristcs of the several populations or other quantitative factors. In particular, San Antonio participants seemed to find the exhaust odors less objectionable and Los Angeles participants seemed to find them more objectionable than did the Chicago, St. Louis, and Philadelphia participants, whose responses were close to the average. Participants and passers-by in Los Angeles were very quick to associate the survey with air pollution, but those in San Antonio had little to say about pollution, and, again, the participants in the other three cities fell between the extremes. San Antonio has the cleanest air of the cities surveyed, and Los Angeles is at least the best known of the five cities for polluted air if it is not in fact most heavily polluted. It is quite possible that a relationship exists between response to diesel exhaust odors (or, for that matter, almost any pollution-related subject) and public awareness of and attitudes toward air pollution, both of which depend on the severity of the local pollution problem and the type and amount of publicity given it. This study did not make an accurate determination of public attitudes and knowledge about air pollution, but the strength and frequency of the aforementioned unsolicited comments made to the survey crew give a qualitative indication of public concern. The indication is that high local pollution and/or high awareness of it are associated with more objectionable characterization of odors, and vice versa. Highly concerned citizens might rate the odors they perceive as being slightly more objectionable than they actually are in the hope that they can thereby strike a blow at pollution in general.
APTIC-23408

### REPORT ON STIMULATION OF COMMUNITY COOPERATION IN AIR CONSERVATION.

California Univ., Santa Barbara, Dept. of Science and Industry, NAPCA Grant 1 R13 AP00767, 150p., 1970. 1 ref.
Sidney Goren.
Identifiers: *Education, *Meetings, *Public affairs, Abatement, Control agencies, Regional governments, Legal aspects, Citizens groups, California.

An effort is documented to bring to the people of the Santa Barbara area sufficient information on the subject of air pollution control to permit them to participate intelligently in what was intended to be subsequent discussions pertaining to the establishment of an air control district in that area. A pilot conference and a final conference were held; the latter, dated June 20, 1969, is reported in its entirety. The final conference was well publicized, had a select list of speakers of international repute, and was essentially free to all persons who cared to attend. The abstracts, transcribed presentations, discussion, and letter and press publicity releases are included in the report of the conference. Subjects covered included the definition of air pollution and its effects, the relationship of air pollution to respiratory disease, definition of an air control district, legal and engineering aspects, and the effects of the Air Pollution Act of 1967. The attendees were most complimentary in their comment on the conference. The hearings for the creation of a Santa Barbara Air Control District were rescheduled to precede the conferences. The conferences were poorly attended.
APTIC-23424

### THE POLITICS OF AIR POLLUTION: PUBLIC INTEREST AND PRESSURE GROUPS.

For primary bibliographic entry see Field 12.
APTIC-23724

13

14

**AIR POLLUTION.**
In: Physical Resources. Dec. 1969, p. 3.10-3.20. 4 refs. CFSTI: PB-190176
Personal Author Not Recorded.
Identifiers: *Planning and zoning, *New york state, Control agencies, State governments, Legislation, Regulations, Socio-economic factors, Air quality standards, Combustion products, Fuels, Industrial emission sources, Incineration, Winds, Precipitation, Temperature (atmospheric), Inversion.

While the problems presented by precipitation, temperature, and wind conditions must be considered and planned for in the construction of various facilities and the location of land uses, there is one major problem associated with climate which is man-made and can therefore be altered. Causes, ingredients, problem areas, and controls of air pollution are mentioned. Surface based and subsidence temperature inversions are discussed, as well as emissions from industrial processes, fuel combustion, and incineration. New York State ambient air quality standards and the land use association for the five general levels of air contamination are presented. Guidelines are suggested for use in anticipation of problems associated with climatic conditions in future regional planning. Issues and implications, trends, and economic factors are cited. The available organizations for the implementation of control plans at the state, regional, and municipal levels are described and their working tools, from state regulations and legislation to municipal ordinances, are considered.
APTIC-24009

**STATEMENT OF BENJAMIN LINSKY, P. E., PROFESSOR IN AIR POLLUTION CONTROL ENGINEERING, DEPARTMENT OF CIVIL ENGINEERING, WEST VIRGINIA UNIVERSITY, MORGANTOWN, W. VA.**
For primary bibliographic entry see Field 12.
APTIC-24044

**ENGINEERING THE METROPOLITAN ENVIRONMENT.**
Eng. J. (Montreal), 53 (6):16-25, June 1970. 10 refs.
(Presented at the Engineering Institute of Canada, Annual Meeting, Vancouver, B. C., Sept. 10-12, 1969, Paper EIC-70-CIV 4.)
James W. MacLaren.
Identifiers: *Air resource management, *Regional governments, Abatement, Area surveys, Costs, Legislation, Planning and zoning, Regulations, Social attitudes, Canada, Odors, Oxidants, Particulates, Solid waste disposal, Water pollution, Hydrocarbons, Carbon monoxide, Nitrogen oxides, Sulfur dioxide.

It is important to recognize the benefits that can accrue to the urban environment in the adoption of regional government and to be aware of the restrictions that can still obtain in engineering the optimum system. It should be recognized that in regard to water supply, solid waste disposal, waste water control and air pollution control, the regional concept is developed not for local servicing but to establish framework schemes. Every regional activity must be developed in the best interest of the area but with a full awareness of its effects on other activities. Too often, political and single purpose thinking establishes the regional system and its development plan and the 'best fit' comprehensive approach is bypassed. It has been demonstrated that engineering the regional or metropolitan environment requires some difference in appreciation than might be necessary in typical municipal design. It is essential that this difference be appreciated in relation to sepcific experience to date. The implications of regional development in terms of water supply, waste water control, solid waste disposal, air pollution control, financing, and legislation are elaborated. A comprehensive study of the air pollution situation should result in an air resource management program including air quality monitoring, emission inventory, air quality standards based on criteria, and a thorough knowledge of the local conditions influencing the transport of pollutants. Implementation of the air use plan should include regulations to reduce odors, particulates, sulfur dioxide, hydrocarbons, carbon monoxide, oxidants, and nitrogen oxides. A metropolitan effort is necessary to successfully achieve these goals.
APTIC-24091

**THE CULTURAL BASIS FOR OUR ENVIRONMENTAL CRISIS.**
Science, 170 (3957):508-512, Oct. 1970. 11 refs.
(Presented at the Man and Environment Conference, Tempe, Arizona, April 16, 1970.)
Lewis W. Moncrief.
Identifiers: *Socio-economic factors, *Social attitudes.

The published contention of L. White that Judeo-Christian teachings are the root cause of the pollution that created the current environmental crisis is disputed by reference to contrary evidence both within White's publication and in documented history. Three dominant features of the American culture that promulgated the present conditions and mediate against a quick solution are identified as an absence of personal moral direction concerning our treatment of our natural resources; an inability on the part of our social institutions to make adjustments to this stress; and an abiding faith in technology. An almost universal short-sighted tendency to maximize immediate self interest, both personal and corporate, and a widespread willingness to shift production costs to society to promote individual ends transcends geographic limitations, political identifications, and ethical-religious philosophies. The blame for the environmental crisis is attributed to 'increasing population, increasing production, increasing urban concentration, and increasing real median incomes' which are founded more in the industrial revolution than in Judeo-Christian philosophy.
APTIC-24094

## 14. GENERAL AND MISCELLANEOUS

**18TH ANNUAL ELECTRICAL INDUSTRY FORECAST.**
Elec. World, 168 (12): 121-136, Sept. 1967.
Personal Author Not Recorded.
Identifiers: *Electric power production, *Area surveys, *Costs, Sources, Industrial emission sources, Nuclear power plants, Reactors (nuclear), Non-industrial emission sources, Data analysis, Statistical analyses, Administrative and social, Administration, Plans and programs, Control programs.

A general upward trend in power generation, plant construction, and electric consumption is predicted for the period 1967-71 in a series of seven articles. Economic indicators as of mid-Sept. provide the basis for predicting a kwhr growth for 1967 of 6.2% above the previous year. While residential sales have carried their share of the growth for the year with a projected 7.5% rise, industrial sales have shown an increase of 8.9% over 1966. The electric power industry plans to build 102,400 circuit miles of new overhead transmission lines, 2000 cable miles of underground transmission, to install 21,700 3-phase T&D substation transformer banks aggregating 732,000 Mva, to erect 231,733 miles of overhead distribution, to bury over 77,700 cable miles of underground primary distribution lines, and to install over 195-million kva of new distribution transformers from 1967 to 1973. Significant increases in kwhr sales from 1970 to 1985 are predicted for use in producing aluminum and magnesium, and for use by the AEC. Aluminum and magnesium production should require 76.8 billion kwhr by 1970, 95.5 billion by 1975, 109.3 billion by 1980, and 153.6 billion by 1985. The AEC's usage should grow from an estimated 18.8 billion kwhr in 1970 to 56.4 billion in 1980. Present plans call for about 8000 Mw of nuclear units to be installed in 1971. It is reasonable to expect installations to reach 12,000 Mw in 1975, 22,000 in 1980, and 30,000 in 1985. This would mean investments of about 15 billion dollars during 1985, some of which will be directed to reducing air and water pollution.
APTIC-18206

**A PROCEDURE FOR THE DETERMINATION OF MINIMUM CHIMNEY HEIGHTS.**
(Ein Verfahren zur Bestimmung von Schornsteinmindesthoehen). Text in German.
Intern. J. Air Water Pollution (London), vol. 6: 27-48, 1962. 17 refs.
F. Wippermann, and W. Klug.
Identifiers: *Stacks, *Height finding, Germany, Stack gases, Design criteria, Turbulence (atmospheric).

A method of determining minimum chimney heights necessary in order not to exceed a given maximum permissible concentration of gas at the surface is described. The formula is a function of emission data, maximum permissible surface concentration, and the properties of turbulent air motion. The theoretical basis for the method is given by showing the derivation of the formulae used and explaining the choice of meteorological parameters. The preparation of the values for the nomograms and the use of the nomograms are discussed. (Author abstract modified)
APTIC-22258

**SOIL, WATER AND AIR COMMITTEE ROTTERDAM. REPORT FOR THE YEAR 1966.**
(Commissie bodem, water end lucht Rotterdam. Verslag over het jaar 1966). 59p., 1967. Translated from Dutch. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 96p., Oct. 6, 1969.
Personal Author Not Recorded.
Identifiers: *Rotterdam, *Abatement, Mortality, Health impairment, Europe, Smokes, Steam plants, Incineration, Air quality measurements, Winds, Rain, Hydrocarbons, Metal compounds, Carbon monoxide, Nitrogen dioxide (no2), Sulfur dioxide, Ph.

The annual report from Rotterdam's Soil, Water and Air Committee is presented. The activities of municipal and private companies in terms of pollution control are discussed. The electric company addition will burn only natural gas; the new waste disposal unit is designed to be essentially pollution-free; abandoned cars are being removed from the roads. Specific problems in local air, water, and soil areas are discussed. The results of a study relating air pollution to sickness and death are presented. Atmospheric conditions and contaminant measurements made during 1966 are tabulated. Included are rainfall, smoke, wind characteristics, hydrocarbons, metals, carbon monoxide, nitrogen dioxide, sulfur dioxide, and pH. Proposals for the formulation of rules for maximum emission concentrations are being studied.
APTIC-22326

**THE DETERIORATING OUTDOORS. SOME ASPECTS OF THE CHEMISTRY OF AIR POLLUTION.**
American Inst. of Medical Climatology, Philadelphia, Pa., Proc. Symp. Air Pollution Health, Philadelphia, Pa., 1966, p. 6-11. 3 refs. (April 21.)
I. C. Hisatsune.
Identifiers: *Pollutants, Aerosols, Smog, Coal, Fuel oils, Internal combustion engines, Hydrocarbons, Nitrogen oxides, Sulfur oxides, Ozone, Photochemical reactions, Reaction mechanisms.

Air pollutants may be classified into two groups, primary and secondary pollutants. The primary pollutants include nitrogen oxides, sulfur oxides, hydrocarbons, aerosols, and radioactive substances. The secondary pollutants are formed from the reactions of primary pollutants. In the

Los Angeles smog, nitrogen and sulfur oxides appear to be two of the important primary pollutants. More than half of these oxides come, respectively, from internal combustion engines and from the burning of coal and fuel oil. Once the oxides of sulfur and nitrogen are in the atmosphere, they may react chemically with other constituents of the air or they may interact with sunlight. Photochemical reactions lead to a complicated series of chemical reactions. Nitric oxide reacts with the oxygen in air to give a brown nitrogen dioxide gas. Nitrogen dioxide absorbs strongly in the visible region of the light spectrum and photodissociates into NO and atomic oxygen. The NO can be reoxidized and go through the photochemical cycle again. The second product, atomic oxygen, is a highly reactive species; ozone can be formed as one of the atomic oxygen reaction products. The interaction of sunlight and SO2 can lead to an equally complicated sequence of chemical reactions. Several non-photochemical reactions of the primary pollutants are also discussed.
APTIC-22388

### PHYSICIAN'S GUIDE TO AIR POLLUTION.

J. Am. Med. Assoc., 186 (6): 605-609, Nov. 9, 1963. 6 refs.
Melvin I. Weisburd.
Identifiers: *Medical personnel, *Public information, Standards, Health impairment, Smog, Sources, Fuels, Industrial emission sources, Transportation, Air quality measurements, Dispersion, Meteorology, Carbon monoxide, Nitrogen dioxide (no2), Sulfur dioxide, Photochemical reactions.

While the control of air pollution may appear to be beyond the scope of his practice, the physician can contribute medical standards and informed leadership to the community effort. Surveys of the effects of air pollution, development and use of methods to provide more sensitive diagnosis of lung function and disease, special case studies, and explanation and publication of information on the pollution problem could also be undertaken by the medical society. Annoyance is usually expressed in terms of some insult to the sense perceptions: haze, odor, smoke, dust, soiling, corrosion, erosion, oxidation, plant damage, eye or respiratory irritation, or other physiological responses. Photochemical or oxidizing smog is defined, while sources of pollution are enumerated as fuel-use, industrial operations, transportation, and non-manufacturing operations. Emissions rates are presented tabularly for nitrogen dioxide, sulfur dioxide, carbon monoxide, and several other compounds. Pollution accumulation occurs during conditions of atmospheric stability, low wind speeds and near-surface temperature inversions, whereas rapid dispersion takes place during high winds, indefinite vertical mixing, and precipitation. Air quality measurements and other factors relevant to estimating pollution potentials are also included.
APTIC-22462

### COMBINING PROTECTIVE AND ORNAMENTAL CHARACTERISTICS OF WOODY PLANTS.

In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Effects and Symptoms of Air Pollutes on Vegetation; Resistance and Susceptibility of Different Plant Species in Various Habitats, In Relation to Plant Utilization for Shelter Belts and as Biological Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver Spring, Md., American Institute of Crop Ecology, 1969, p. 90-93. 2 refs. (Also: Akad. Nauk SSSR. Ural. Filial. Komis. po Okhrane Prirody. Rastitel' nost' i promyshlennye zagryazneniya. Okhrana prirody na Urale. V. (Sverdlovsk), 1966, p. 157-163.)
L. I. Vigorov.
Identifiers: *Trees, *Abatement, Leaves, Blood vessels, Nervous system, Lungs, Toxic tolerances, Carcinogens, Ussr, Combustion gases, Dusts, Absorption.

In the planning of verdant plantings it is desirable to combine the ornamental properties of plants with the utility for man's health. In this respect, two groups of ornamental plants suggest themselves. The first group consists of ornamental apple and pear trees, bigfruit hawthorn, sweet mountain ash, chokeberry, sweetbrier, sea buckthorn and sweet viburnum. The second group includes trees and shrubs that absorb noxious gases, carcinogens, and radioactive dust from the air. They strongly ionize the air and emit a large quantity of substances that favorably affect the lung tissue, blood vessels, and nervous system of man. However, the absorptive activity of plants and their gas resistance will have no material significance as developments continue in air pollution control. The effect of some plants, such as azalea flowers and walnut leaves, is harmful. The rapidity with which alkaloids and narcotics act when smoked indicates the brain's reaction to inhaled substances. Until man can artificially make up the air composition that best suits his needs, the only means for changing the surrounding atmosphere is to enrich it with beneficial substances emitted by plants.
APTIC-22488

### EFFECT OF PLANTINGS OF THE SANITARY AND HYGIENIC CONDITIONS OF DENSELY POPULATED SETTLEMENTS.

In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Effects and Symptoms of Air Pollutes on Vegetation; Resistance and Susceptibility of Different Plant Species in Various Habitats, In Relation to Plant Utilization for Shelter Belts and as Biological Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver Spring, Md., American Institute of Crop Ecology, 1969, p. 25-27. (Also: Akad. Nauk SSSR. Ural. Filial. Komis. po Okhrane Prirody. Rastitel' nost' i promyshlennye zagryazneniya. Okhrana prirody na Urale. V (Sverdlovsk), 1966, p. 87-89.)
Yu. G. Novoderzhkina, L. A. Andrianova, and G. G. Zheldakova.
Identifiers: *Plants (botany), *Air quality measurements, *Abatement, Trees, Ussr, Residential areas, Dusts, Gas sampling, Winds, Humidity, Micrometeorology, Temperature (atmospheric), Carbon monoxide, Sulfur dioxide.

One of the most effective methods for combatting air pollution is planting greenery. Studies were made of the effect of different types of plants in relation to large apartment buildings. Air samples were taken by the aspiration method and analyzed for carbon monoxide, sulfur dioxide, and dust contents. The study showed that the best living conditions are in areas of widely spaced buildings, well provided with greenery, and separated from the street by an 8 m wide green strip. In such sections, the dust concentration in July and August did not exceed 0.4-0.5 mg/cu m, and the CO concentration did not exceed 0.6 mg/cu m. The worst conditions were found in areas of widely spaced buildings with no green plants. In all the residential sections studied, the SO2 concentration did not exceed 0.1 mg/cu m. The relative humidity in the widely spaced sections with green plants was 15% to 24% higher than in a similar section with no greens. The temperature at the hottest time of day was 3 C lower than in sections devoid of greenery. Green plants also affect solar radiation and regulate the air movement near the surface. The properties of green plants make them essential factors affecting the sanitary and hygienic conditions of residential areas.
APTIC-22493

### RECOMMENDED PROCEDURES FOR PLANTING SANITARY-PROTECTIVE GREEN BELTS IN AREAS OF INDUSTRIAL ENTERPRISES.

In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Effects and Symptoms of Air Pollutes on Vegetation; Resistance and Susceptibiltiy of Different Plant Species in Various Habitats, In Relation to Plant Utilization for Shelter Belts and as Biological Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver Spring, Md., American Institute of Crop Ecology, 1969, p. 28-31. (Also: Akad. Nauk SSSR. Ural. Filial. Komis. po Okhrane Prirody. Rastitel' nost' i promyshlennye zagryazneniya. Okhrana prirody na Urale. V (Sverdlovsk), 1966, p. 169-172.)
V. D. Pryakhin.
Identifiers: *Trees, *Combustion products, *Abatement, Leaves, Ussr, Industrial areas, Combustion gases, Aerosols, Dusts, Soot, Smokes, Ventilation, Collectors, Diffusion, Winds, Sulfur dioxide.

Planting sanitation and protective belts is an important method of protecting the air in industrial cities. However, green plantings cannot be considered as natural, limitless absorbers of toxic gases. When the air is polluted by aerosols, dust, soot, and smoke, green plants will retain the suspended particles on their leaves, branches, and trunks, and the rain will wash them down. The decisive measures in combatting air pollution by noxious gases are smoke and gas catchers and recuperative units, and their effective maintenance. Properly designed green plantings in sanitary-protective areas, can and should perform several important functions: contribute to systematic ventilation of the area and insure the diversion of polluted air in a horizontal direction away from residential and industrial areas; contribute to the formation of vertical air currents to carry polluted air from the area and disperse it in higher atmospheric layers; and purify the air of aerosols, dust, soot, and smoke. The green plants should not collect noxious gases, and they should reduce the wind velocity in the direction of the residential areas. The trees and shrubs should have the greatest possible branching and leaf coverage. All these basic requirements are satisfied by narrow strip plantings with 40 cm between the strips of shrubs and 50 cm between trees.
APTIC-22494

### URGENT QUESTIONS CONCERNING VERDANT PLANTINGS IN THE CITY OF BAKU.

In: American Institute of Crop Ecology Survey of USSR Air Pollution Literature. Effects and Symptoms of Air Pollutes on Vegetation; Resistance and Susceptibility of Different Plant Species in Various Habitats, In Relation to Plant Utilization for Shelter Belts and as Biological Indicators. M. Y. Nuttonson (ed.), vol. 2, Silver Spring, Md., American Institute of Crop Ecology 1969, p. 76-78. (Also: Akad. Nauk SSSR Ural Filial Komis. po Okhrane Prirody. Rastitel'nost i promyshlennye zagrazneniya. Okhrana Prirody na Urale. V (Sverdlovsk), 1966, p. 177-179.)
A. G. Aliev.
Identifiers: *Plants (botany), *Trees, *Abatement, Leaves, Plant damage, Ussr, Urban areas, Combustion gases, Dusts, Soot, Fly ash, Smokes, Oxygen.

As a result of many years of selection and utilization of drought- resistant woody and herbaceous plants, the city of Baku in the USSR has been transformed into one of the most verdant cities. Air pollution by noxious gases, smoke, and dust must be combated. In the spring and summer, the leaves and shoots of plants turn gray because of dust and soot. Ash particles accumulate in leaf stomata, interfering with the normal plant transpiration. The air under the trees is dusty and breathing is difficult. In these conditions, the usefulness of green plantings to man is greatly reduced. The flowers of shrubs and herbaceous plants must be washed off by sprinkling. This removes the soot and dust, moistens the air and soil, thereby providing favorable conditions for normal plant development, while enriching the air with water vapor and oxygen. Suggestions are given for improving the green plantings of hospitals and sanatariums in the Baku area.
APTIC-22497

### PROBLEMS IN THE CONSTRUCTION OF HIGH SMOKESTACKS IN THE GERMAN DEMOCRATIC REPUBLIC.

(Probleme beim Bau hoher Schornsteine in der
DDR). Text in German. Energietechnik, 17
(12):550-551, Dec. 1967.
Guenter Conrad.
Identifiers: *Stacks, *Design criteria, Construction materials, Concrete, Germany, Stack gases, Electric power production, Height finding, Ground level, Winds, Sulfur dioxide.

Problems connected with the designing and construction of high industrial smokestacks as they emerged during the planning of the construction of a 300 m high steel-concrete smokestack for the Boehlen II power plant in East Berlin are discussed. This height was necessary if the ground sulfur dioxide concentration was not to increase above its present levels with the projected draught capacity of 7.5 million cu m flue gas per hour. Decisive for the steadiness of so high a structure was the correct determination of the wind stress factor which was calculated from data about wind currents, velocity, and frequency supplied by the Meteorological Service and from wind tunnel experiments. A concrete lining reinforced by locally available materials is foreseen for the flue gas duct proper to be built inside the static smokestack column. The empty space between the flue and the column is designed to reduce the heat stress on the structure and will permit easy inspection of the lining. While present technology permits a daily erection of 2.5 m of the structure with the protective lining being constructed with the help of a separate scaffolding, specially constructed sliding shells foreseen for this construction are expected to increase the daily construction of both the column and the lining to 4 to 6 m.
APTIC-22500

### STUDY OF STACK-GAS FLOW ON LSD28- AND LSD32-CLASS SHIPS FROM TESTS WITH MODEL 4552 IN THE CIRCULATING WATER CHANNEL.

David Taylor Model Basin, Carderock, Md.,
Hydromechanics Lab. Rept. 1335, 23p, July 1960.
4 refs. CFSTI, DDC: AD 650608
N. L. Ficken, and H. F. Lo.
Identifiers: *Smokes, *Stacks, *Plume behavior, Stack gases, Ships, Simulation, Winds, Turbulence (atmospheric).

During preliminary acceptance trials of the LSD 28, smoke from the stacks presented a serious problem. Under certain conditions, smoke and soot from both stacks descended into the drydock well and onto adjacent dock areas. To determine whether raising stack heights would alleviate the problem, tests were conducted with models of the superstructure of the LSD 28 and LSD 32-class ships in a circulating water channel. In these tests, the water flowing by the model represented the wind and a dye solution ejected from the stacks simulated the smoke. Photographs of the simulated smoke patterns showed that when the relative wind is approximately ahead or astern of the stacks, smoke was released into a turbulent mixing zone and carried to the decks of the superstructures. The best solution to this problem is to project the stacks beyond the turbulent boundary zone. When this is not possible, stack gases must be ejected at a speed sufficient to cover the deficiency in height. This is a function of stack-velocity ratio and cannot be defined as absolute stack velocity.
APTIC-22742

### ACCOUNTING FOR ATMOSPHERIC TURBULENCE WHEN SELECTING THE CAPACITY AND HEIGHT OF INDUSTRIAL CHIMNEYS.

(Uchet osobennostey atmosfernoy turbulentnosti
pri raschete moshchnosti i vysoty trub
promyshlennykh predpriyatiy). Text in Russian.
Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana,
1 (11):1205-1208, 1965. 6 refs.
D. L. Laykhtman, F. A. Gisina, and N. I. Kramer.
Identifiers: *Stacks, *Height finding, *Turbulence (atmospheric), Ussr, Operating variables, Mathematical analyses, Ground level.

The problem of selecting parameters for industrial chimneys so that maximum ground-level impurity concentrations will be below maximum allowable concentration within a given probability is examined taking into account atmospheric turbulence. Two turbulence regimes, small-scale and large-scale, are recognized and formulas are derived for determining chimney capacity and height.
APTIC-22749

### VEGETATION AS AEROSOL FILTER.

Biometeorol. Proc. 3rd Int. Biometeorol. Congr.,
1963, 2 (2):693-702, 1967. 14 refs. (Sept. 1-7.)
H. Neuberger, C. L. Hosler, and W. C. Kocmond.
Identifiers: *Forests, *Pollens, *Filters, Trees, Particulates, Ragweed, Aitken counters, Samplers, Impingers, Sedimentation, Winds.

Measurements of ragweed-pollen concentrations inside and outside a forested area during two seasons revealed that 100 m inside a dense coniferous forest, more than 80% of the pollen is removed from the air; deciduous trees seem somewhat less effective in this respect. The measurements during 1953 were made with a volumetric impinger which poses problems for non-isokinetic aspiration speeds; in 1959, the measurements were repeated with a rotorod sampler as modified at the University of Michigan. Measurements were made in the Nittany Valley of central Pennsylvania. Laboratory determinations of the filtering effect of coniferous and deciduous plant material on Aitken nuclei showed the coniferous material to remove on the average 34% (477 measurements) and the deciduous material 19% (9348 measurements) of the submicroscopic particulate matter from the air. The greater reduction of pollen than of nuclei concentrations seems to indicate that sedimentation, facilitated by the reduction of wind speed in forests, plays an important role in the total process of filtering micron-size particles. (Author abstract modified)
APTIC-22786

### DIAGRAMS FOR THE ESTIMATION OF SMOKESTACK HEIGHT NECESSARY FOR A POLLUTION-FREE ATMOSPHERE.

(Diagramme zur Beurteilung der Eignung von
Schornsteinhoehen fuer die Luftreinhaltung). Text
in German. Staub (Duesseldorf), 23 (7):335-343,
July 1963. 7 refs.
Friedrich Wippermann.
Identifiers: *Height finding, *Stacks, Germany, Mathematical analyses, Ground level, Diffusion, Winds.

Smokestack height is governed by ground pollutant concentration at the foot of the smokestack under the given level of emission. By using frequency distribution of the wind velocity as the most important parameter of the theory of diffusion of pollutants, diagrams were drawn resulting from calculations of smokestack heights required for pollution prevention, from calculations of the sizes of areas in which the permissible ground concentration was exceeded from calculations of the frequency of excesses of permissible concentrations, and from calculations of distances with maximal gas concentration from the pollution source, permitting the prediction of the maximal ground concentration of an emitted pollutant gas, of its frequency, of the frequency of transgression of the maximum permissible level, and of other data concerning the pollution level and extent. Since all meteorological parameters were constant in the calculations except wind velocity, the predictive data derived from the diagrams have limited validity and should be used for orientation only.
APTIC-22793

### CONSTRUCTION OF POWER PLANT STACKS IN THE LIGHT OF PRACTICAL EXPERIENCE.

(Betriebserfahrungen mit
Kraftwerkschornsteinen und ihre Konstruktion).
Text in German. Mitt. Ver. Grosskesselbesitzer,
48 (6):436-444, Dec. 1968.
W. Wein.
Identifiers: *Electric power production, *Stacks, *Design criteria, Concrete, Corrosion, Steel, Surface coating, Germany, Sulfuric acid, Carbon dioxide, Sulfur dioxide, Sulfur trioxide, Temperature.

The three types of power plant stacks which perform satisfactorily are single or collecting stacks with a shaft of brickwork, steel concrete or a combination with an acid resistant lining with or without a space that can be ventilated, single concrete stacks with a suspended insulated steel flue duct, and a frame structure with several suspended insulated steel flue ducts. Stacks can be damaged by excessive thermal stress, by too short a drying time, and by corrosion of and damage to brickwork, mortar or concrete. To prevent excessive thermal stress, heat conduction stacks must be lined to a height of from one third to one half with a thermal protective lining, but a lining of the entire height of the stack is recommended, especially for steel concrete shaped brick stacks. The maximal permissible temperature difference between the outside and the inside surface of brickwork stacks, depending on thickness, is 140 C; for steel concrete and concrete brick stacks, 20 C. These temperatures must be periodically checked. Newly constructed stacks must be brought into operation very slowly so that the humidity in the mortar or concrete are not expelled to quickly. The danger of corrosion caused by the oxidation of sulfur dioxide to sulfur trioxide, the formation of sulfuric acid and its condensation can be minimized by firing with a small surplus of air which reduces the condensation point of H2S04. Measuring instruments recommended for smokestack damage prevention should measure pressure or underpressure in the flue and in the space between the lining and stack, the temperature gradient of the flue gas from foot to top of the stack, carbon dioxide content between stack and lining, and the temperature difference between the inside and outside walls of the stack.
APTIC-22794

### CAMP PARKS MASS FIRES. (FINAL REPORT).

Naval Radiological Defense Lab., San Francisco,
Calif., OCD Contract DAHC20-67-C-0149, Work
Unit 2561A, USNRDL TR-69-A, 41p., Aug. 1969.
4 refs. CFSTI, DDC: AD 704144
C. P. Butler.
Identifiers: *Mathematical modeling, *Fires, *Wood, Urban areas, Simulation, Air pollution forecasting, Carbon monoxide, Combustion.

The possibility of predicting the behavior of large, full-scale urban fires by extrapolating from small-scale burns was investigated. Data were obtained from 10 small-scale model burns and 1 full-scale burn of a barracks section to find the scaling factors that are most sensitive in determining burning characteristics of wood structures. Parameters measured included total energy release rate, total thermal radiation, and carbon monoxide concentrations at scaled street levels, as well as carbon monoxide concentrations in a model basement. Dynamic burning characteristics of 1/16- scale plywood models show that the ratio of total thermal radiation to the total energy release rate at maximum burning rate is 30% for unskirted models, 25% for skirted models, and 8% for the full-scale building. Carbon monoxide exceeds 100 ppm 15 minutes after ignition in a skirted model basement and between two models at scaled street level distances. Interactions between two models at a scaled distance of seven feet increased the burning rate by a factor of 2 as compared to scaled 25 ft.
APTIC-22796

### PROPOSAL FOR AN EMPIRICAL FORMULA FOR CHIMNEY HEIGHTS.

(Vorschlag einer empirischen Formel fuer die Schornsteinueberhoehung). Text in German.
Staub (Duesseldorf), 23 (12):549-556, Dec. 1963. 8 refs.
Hermann Stuemke.
Identifiers: *Stacks, *Height finding, Germany, Stack gases, Design criteria, Mathematical analyses, Flow rates.

A formula for determining proper stack heights is presented. A four-parameter formula which represents a generalization of the formulae by Holland and by Lucas-Moore-Spurr and which, in the limiting case of cold flue gases, reduces to the impulse expression evaluated by Rupp and others in wind tunnel experiments, is taken as the starting point. The four free parameters are so fixed on the basis of systematic calculations that the formula resulting therefrom describes as well as possible the entire available observation data which is summarized in five collectives. The structure of this formula further indicates that the emission velocity has a lesser effect on hot flue gases towering above the stack than the two comparison formulae would seem to indicate.
APTIC-23643

### METHODOLOGY FOR EVALUATING THE AIR POLLUTION PROBLEMS OF A STATE.

Preprint, American Industrial Hygiene Assoc., Detroit, Mich., 18p., 1957. 2 refs. (Presented at the American Industrial Hygiene Association Annual Meeting, St. Louis, Mo., April 25, 1957.)
Donald M. Keagy, Paul A. Keline, E. R. Hendrickson, and Roy O. McCaldin.
Identifiers: *Survey methods, Personnel, Questionnaires.

The methods described were developed and used in three state-wide air pollution appraisals in Connecticut, Washington, and Tennessee. The methodology does not include air sampling and analysis but extensively and intensively exploits all existing data in a state relative to air pollution problems. Procedures useful in obtaining this data include questionnaires, interviews, visual observations, review of materials in libraries and office files, estimation, and computation based thereon. For the states mentioned, the approach required about one man-year of effort. Though such a study can be a one-man operation, a minimum of two men and a secretary is preferable. The results serve as a guide for state and local officials as a sound starting point for an active program, and a base line for future evaluation of air problems or programs. Sample air pollution survey questionnaires and interview data sheets are included.
APTIC-23747

### VORTEX RINGS FOR EFFLUENT REMOVAL.

Engineering (London), 209 (5431): 578, June 5, 1970.
Charles Simpson.
Identifiers: *Stacks, *Plume behavior, Stack gases, Height finding, Mathematical modeling, Ground level, Transport, Winds, Inversion.

Among possible methods of reducing ground level pollution is the concept of a chimney literally blowing rings instead of a steady plume. A fluidic chimney complex is described which has the ability to eject discrete vortex smoke rings. Tests with a 20 ft high model chimney showed that vortex rings can double the height of penetration over that obtained by steady-state plume emission. This is because smoke is transported through the atmosphere by a rolling motion, rather than by a sliding one as in normal emission. The major application of such a device is likely to be in conditions of strong temperature inversions where there is little or no wind. Several fluidic designs that allow the effluent to be released intermittently are described. Investigation of the model complex shows the success achieved in ejecting discrete rings, but the noise produced and the power required need investigation. With the model system, the stack needs to have a height of approximately eight diameters.
APTIC-23919

### PROBLEMS INVOLVED IN DETERMINING MINIMUM STACK HEIGHT ON THE BASIS OF METEOROLOGICAL AND AIR QUALITY CONSIDERATIONS.

(Zur Problematik der Ermittlung meteorologisch-lufthygienisch begruendeter Schornsteinmindesthoehen). Text in German.
Energietechnik, 17 (12):547-549, Dec. 1967.
Joachim Kolbig.
Identifiers: *Height finding, *Stacks, Germany, Coal, Electric power production, Mathematical analyses, Dispersion, Winds, Turbulence (atmospheric).

Large plants with a power output of more than 2000 MW, whose chimney height exceeds 150 meters experience difficulties. The basis for calculation is a formula of Bosanquet and Pearson, which gives pollutant concentration to windward of the source in terms of the quantity of pollutants emitted per unit time, wind velocity, distance from source, turbulence parameters, and effective stack height. This is applied to a discussion of power plants to be constructed in the future, such as plants burning lignite and producing electric power at the rate of 3000 MW and higher. Recommended stack heights are given in tables.
APTIC-23974

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APTIC-22388 14

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APTIC-23905 02

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APTIC-24080 02

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APTIC-23870 08

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APTIC-23406 06

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APTIC-22217 03

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APTIC-24054 09

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APTIC-24140 09

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APTIC-23416 06

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APTIC-23936 07

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APTIC-23691 05

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APTIC-22723 06

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APTIC-22192 05

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APTIC-23758 08

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APTIC-22570 08

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APTIC-22496 08

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METHODOLOGY FOR EVALUATING THE AIR POLLUTION PROBLEMS OF A STATE.
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KEENAN, J. H.
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APTIC-22779 02

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THE 'USPHS' METHOD FOR DETERMINING LEAD IN AIR AND IN BIOLOGICAL MATERIALS.
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KEMPINSKI, WALDEMAR
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KHAN, A. A.
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KICE, JACK W.
AIR FILTER WITH FLUIDIC TIMING MECHANISM.
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CORROSION-RESISTANT LOW-ALLOY STEELS A REVIEW WITH PARTICULAR REFERENCE TO ATMOSPHERIC CONDITIONS IN THE UNITED KINGDOM.
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KIMBER, R. W. L.
MODE OF FORMATION OF 3,4-BENZOPYRENE IN HUMAN ENVIRONMENT.
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KIMURA, KIKUZI
ON THE PENETRATION RATE OF GASEOUS MATTER OF INHALED GAS-AEROSOL MIXTURES IN SIMPLE RESPIRATORY MODEL.
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KIM, D. S.
SYNCHROTHERMAL REACTOR SYSTEM FOR CONTROL OF AUTOMOTIVE EXHAUST EMISSIONS.
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A NEUTRAL AND ION MASS SPECTROMETER FOR ENVIRONMENTAL GAS COMPOSITION OF THE APOLLO TELESCOPE MOUNT. EXPERIMENT NO. T 030. (FINAL REPORT).
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THE METHOD AND APPARATUS FOR REMOVING DILUTE SULFUR OXIDES CONTAINED IN COMBUSTION EXHAUST GAS.
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KITAGAWA, TETSUZO
THE RAPID MEASUREMENT OF TOXIC GASES AND VAPORS.
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PLEURAL CALCIFICATION AS A ROENTGENOLOGIC SIGN OF NON-OCCUPATIONAL ENDEMIC ANTHOPHYLLITE-ASBESTOSIS.
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| 24162 | 24163 | 24164 | 24165 | 24166 | 24167 | 24168 | 24169 | 24170 | 24171 | | |

NAME ______________________________ DATE ____________

NAPCA PROGRAM ______________________________

ADDRESS ______________________________

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